Government of His Highness the Maharaja of Mysore.

GENERAL AND REVENUE DEPARTMENTS.

G. O. No. I. C. 5611-70—A. & E. 65-23-11, dated 22nd March 1924.

Administration Report of the Agricultural Department.

Reviews the —— for the year 1922-23.

READ—

Administration Report of the Agricultural Department for the year 1922-23, received from the Director of Agriculture in Mysore, with correspondence ending with his letter No. R. O. C. 349-114, dated the 5th November 1923.

2. Correspondence ending with letter No. I. D. 1243 (b), dated the 19th November 1923, from the same officer furnishing correct figures regarding receipts by cash and transfer of the Central Implement Depot.

3. Correspondence with letter, dated 2nd February 1924, from the Director of Agriculture furnishing additional information on certain points.

ORDER No. I. C. 5611-70—A. & E. 65-23-11, DATED 22ND MARCH 1924.

During the year under review, the Agricultural, Sericultural and Veterinary Departments continued to be under the control of Dr. L. C. Coleman till the afternoon of the 28th March 1923, when he proceeded on eight months' combined leave. From the 29th March 1923, Mr. H. V. Krishnayya, Headquarter Assistant, was officiating as the Director of Agriculture.

SCIENTIFIC SECTIONS.

2. *Chemical Section.*—The following items of work of the Chemical Section deserve mention:—

(*a*) *Potculture-experiments* with phosphatic and nitrogenous manures in red soils were continued.

(*b*) *Field-experiments.*—Continuance of manurial experiments on areca palm, sugar-cane, paddy, ragi and mulberry.

(*c*) Continuance of feeding experiments on calves and milch cattle at the Rayankere Dairy Farm.

(*d*) Continuance of the investigation of the spike disease.

(*e*) Analyses of soils, sugar-cane juice and jaggory, manures, feeding stuffs and fodders.

Some of the above experiments gave definite results.

3. *Mycological Section.*—Special attention was as usual devoted to *Koleroga* of arecanut. In unsprayed areas, heavy loss was caused by this disease and spraying work to combat it was hampered to a considerable degree by continuous rain during the latter part of the monsoon and the want of holder sprayers which did not arrive in time from Germany. Nearly 1,200 acres (in 3 taluks of the Shimoga District and Koppa Taluk of the Kadur District) were sprayed against this disease during the year as against 750 acres in the year 1921-22. The sale of a good number of sprayers during the year has been a noteworthy feature indicating the efficacy and popularity of the remedy. Koleroga is reported to be spreading towards Kigga and Kalasa where it has never before appeared. It is hoped that the garden owners in these parts would avail themselves of the advice of the Agricultural Department in the matter of checking the disease and avert the heavy losses which they would sustain otherwise. The levy of the Supari Cess referred to in the last year's review was abolished with effect from the year 1923-24.

No. I. C. 5611-70—A. & E. 65-23-11, DATED, 22ND MARCH 1924.

Further investigations of the Sandal Spike disease have proved beyond doubt that one of the ways of the spread of the disease was through root connections.

The hybernating stage of the coffee black rot was found and a bulletin on the disease was published during the year. Among other plant diseases which received attention during the year the following may be mentioned:—

Ragi smut, Betel and Grape-vine Mildew.

4. *Entomological Section.*—The main item of work in this section related to the Kamblihula pest. Campaign against this was conducted successfully in parts of Shimoga, Chitaldrug and Kolar Districts and 270,299 moths representing about 135 million caterpillars destroyed. The pest being on the increase in the Kolar District, special attention was given to this district. The simple method for dealing with the Sugar-cane Borer referred to in the last year's review was given further trials and the same yielded good results. Among other pests which received attention were the Coffee Borer, the Castor Semilooper, the Lime tree Borer and two new serious pests reported during the year, one on cardamoms and the other destroying young shoots of ficus trees.

5. *Botanical Section.*—The work in this section was on the lines of previous years and related mainly to work on ragi, sugar-cane and groundnut. Preliminary work regarding paddy selection and potato breeding was started. Testing of fodder crops was started in co-operation with the Live-stock Expert. Some varieties of ragi which were found to be preferable to H22 ragi are being raised for securing seed for distribution. A few varieties of ragi to be grown under irrigation were found which deserve further trial. Hybridization with ragi, cotton and groundnut was continued.

6. *Experimental Farms, Hebbal Farm.*—Work on this Farm was continued on the same general lines as in previous years. Spacing and manurial experiments with sugar-cane, varietal tests, age of seedling and duty of water experiments of paddy, manurial experiments of ragi and varietal experiments of groundnut were also conducted.

Babbur Farm.—The cotton gins established on this Farm were availed of to a greater extent by the neighbouring raiyats for ginning Kappas, the amount realised from fees therefor and quantity ginned being Rs. 704-14-0 and 3,154 maunds respectively for the year against Rs. 101-15-11 and 1,135 maunds 18 lbs. in 1921-22. The working of the gins enabled the supply of good seed enough for sowing 10,000 acres. Sannahatti and Bile Jola were the main crops on dry land. Spacing experiments with 'selection 69' were continued. The main crops on the wet land were sugar-cane, Cambodia cotton and plantains. Improvement of the drainage of wet lands and the physical conditions of the land as a result thereof, were effected during the year. Manurial experiments with paddy and varietal experiments with sugar-cane were conducted.

A large quantity of seeds of Cambodia cotton, selection 69 cotton, H. M. 544 and of J. 33 A sugar-cane was distributed during the year.

Marthur Farm.—Among experiments conducted in this Farm during the year, varietal tests with sugar-cane and ragi and manurial experiments with areca may be mentioned.

Nagenahalli Farm.—The total area under cultivation was 43¼ acres (dry and wet) during the year. Sugar-cane and paddy on the wet area and ragi, jola, horse gram and castor on the dry area were raised. Verietal tests with local and H22 ragi gave better yield for local ragi. For lack of timely rains, jola crop did not thrive well enough to yield grain and the crop was used for fodder. Horse-gram yielded a better crop this year than in 1921-22. Verietal tests with castor seeds of Hebbal Farm yielded better results in the case of H1 variety. The area under paddy was 22·9 acres against 17·9 in 1921-22 and the yield averaged 11 pallas per acre. Varietal and manurial tests and testing of single seedling transplantation of paddy were conducted. The area under sugar-cane during the year was 10 acres and 35 guntas, five varieties of cane being planted besides 12 select seedlings. The sugar-cane crop suffered seriously from several causes one of them being want of water. The receipts and expenditure of the Farm were respectively Rs. 5,797 and Rs. 8,900, of which Rs. 1,425 was non-recurring expenditure. The financial results of operations of the

farm during the year show that the receipts have not even balanced the recurring expenditure. In the case of Farms intended to demonstrate to the public the utility of the agricultural operations carried on on modern lines, the fact that the receipts instead of being much in excess of expenditure have not been even equal to it is a matter of deep concern and cannot be lightly passed over. Government direct that in the future reports on the working of the Farms, full information should invariably be furnished in regard to the receipts, if any, and expenditure together with reasons for the expenditure being in excess of receipts, if such be the case.

7. *District work in Popularizing Improvements.*—This work as usual included inspection of large private estates at the request of their owners for giving advice on agricultural matters, demonstration, sale and hiring out of improved agricultural implements, demonstration of jaggory boiling, and sale of sugar-cane mills and stone threshing rollers, popularization of seed selection, oil cake, green manure and artificial manures and manure mixtures for special crops and economic transplantation of paddy. The reports of the Eastern and Western Division furnish interesting details regarding the above items of work.

The high price of improved agricultural implements and spare parts, and particularly of ploughs has come in the way of their general use. To meet this situation, a plough of a comparatively cheaper sort, designed by the Agricultural Department was made in England and 200 ploughs of this design were received during the year and put up for sale under the name of "Mysore Plough". The total value of the implements sold from depots during the year was Rs. 51,177-0-5 against Rs. 50,508-14-2 during the year 1921-22. The Kirloskar plough increased in popularity and demand for spare shares required for the Kolar Mission plough was met by shares made locally. The use of oil cake and commercial fertilizers expanded during the year. The increase in the popularity of Ammonium Sulphate used in sugar-cane cultivation was phenominal in as much as the quantity purchased by the agriculturists rose to 35 tons during the year against three tons in 1921-22. About 100 tons of oil-cake manure were supplied through the Department and many times this quantity is reported to have been purchased direct by the agriculturists themselves. The use of green manure also has spread to new localities, a large quantity of seeds thereof having been sold. As a result of the distribution by the Department of a better variety of ragi (H22), the area under this crop during the year under report has considerably increased the total extent being estimated at 90,500 acres. The new seedling canes distributed last year gave very satisfactory results and as a result of trials thereof there was a large demand for seeds of H. M. 544 sugar-cane variety and 508,279 setts of this variety were distributed over a wider area. The area under a few other varieties of better canes, better varieties of groundnut and cotton also increased during the year. An apprehended scarcity of fodder in certain parts of the State where for want of later rains, great anxiety was felt, was met by the prompt supply of jola seeds which yielded either good crop or fodder. Forty-seven thousand two hundred and fifty seers of paddy of different kinds, 14,00,000 setts of sugar-cane, 5,246 seers of ragi, 2,044 seers and 213 maunds of groundnut in the eastern and western divisions respectively. Four hundred and fifty pallas of castor, 66 maunds of cotton and 41 maunds of potato were distributed during the year. The following figures represent the budget expenditure, value of transactions etc., relating to the seed and implement depots during the year:—

SEED DEPOT.

BUDGET PROVISION Rs. 10,000.

	Rs.	a.	p.
Expenditure—Purchases of seeds and manures ..	25,850	7	8
Working charges	14,828	0	0
Realizations from sale of seeds and manures ...	22,474	8	9

IMPLEMENT DEPOT.

IMPREST RS. 25,000.

	Rs.	a.	p.
Issue from all depots	51,177	0	5
Collections	61,983	6	7
Balance of arrears outstanding on 30th June 1923, excluding value of stock.	34,461	5	11

No. I. C. 5611-70—A. & E. 65-23-11, DATED 22ND MARCH 1924.

8. *Scheme for associating Co-operative Banking Societies with the sale of Agricultural Implements, etc.*—Noteworthy progress was made in this direction. A scheme was drawn up during the year in consultation with the Registrar of Co-operative Societies for associating under certain conditions, the Co-operative Societies transacting banking business, with the work of stocking and selling agricultural implements, seeds and manures as an adjunct to their banking work. 44 Societies in the Eastern Division and 14 in the Western Division are reported to have entered the scheme. It is hoped that this scheme would work satisfactorily. Two more Societies of the nature of Agricultural Co-operative Societies with cane milling as an important item of work, were formed during the year.

9. *Agricultural Engineering.*—The Agricultural Engineer's work during the year under report, related as usual to teaching in the Hebbal School, supervision of Farm machinery and workshop and construction and supervision of buildings for the Sericultural and Agricultural Departments. The results of trials of the 20 ploughs prepared on the new design of the Department, were considered and after effecting some minor alterations in the design thereof, the specifications were drawn up and blue prints prepared and sent to England for ploughs being constructed.

10. *Live Stock.*—Mr. Davison, Live Stock Expert, spent 190 days on tour during the year. The main items of work attended to in the Live Stock Section were Dairy work at Hebbal, breeding experiments and feeding experiments on the Rayankere Palace Dairy Farm, sheep breeding experiments in the Sheep Farms and demonstration of improved methods of clipping and dipping sheep. One more Holstein Bull was imported for the Rayankere Farm. The total strength of sheep at the Hebbal and Yellachihalli Sheep Farms was 462 of which 287 were ewes and 5 Merino rams. 52 ewes were purchased from Poona and added to the stock. 140 Merino hybrids, 19 country bred and 5 three quarter bred lambs were born on the sheep farms during the year. The expenditure during the year on sheep farms was Rs. 10,086-8-7 of which Rs. 4,785-11-2 was spent on the Yellachihalli Farm and Rs. 5,300-13-5 on the Hebbal Farms. The realizations from the Farms amounted to Rs. 823-8-4. These farms are not run on commercial lines but are intended to serve as experimental farms for improving the sheep breeding industry in the State. A Sheep Breeding Association was formed in the Kolar District during the year for developing the sheep breeding industry.

Government in their Order No. P. 867-926—Mily. 39-23-1, dated the 13th August 1923, have passed orders transferring the Amrut Mahal Department to the Live Stock Expert, subject to the control of the Director of Agriculture. It is hoped that this measure would enable the Live Stock Expert to take necessary steps for improving the draught cattle under the scheme referred to in the last year's Review.

11. *Agricultural Education.*—The Agricultural School at Hebbal and the Sri Krishnarajendra Vyavasaya Dharma Pathasala at Chikkanahalli, Sira Taluk, continued to work satisfactorily during the year. The first Diploma Examination in the Hebbal School since the extension of the course to 3 years, was held in May 1923 and 13 students who sat for this examination passed, 3 of them in the first class pass.

Twelve students of the Krishnarajendra Vyavasaya Dharma Pathasala passed in the annual examination. Experimental and demonstration work, sale of seeds, agricultural implements, etc., were other items of work attended to at the institution. Government passed orders in July last directing the conversion of the Pathasala into a Government Institution and raising the scale of expenditure incurred by Government on account of the school. Orders have recently been passed on the proposals of the Director improving the institution on its present basis and increasing the scale of expenditure from Rs. 3,524 to Rs. 4,219 per year.

12. The total expenditure of the Agricultural Department proper was Rs. 3,35,799-11-9 during the year.

13. *General.*—The Director of Agriculture Dr. L. C. Coleman was on tour for 101 days during the year. The Deputy and Assistant Directors spent on tour during the year 165 and 222 days respectively against 168 and 201 days in the previous year.

The total number of works in the Library of the Office of the Director of Agriculture was 12,000 including bulletins. The number of periodicals received in the Library was 88.

No. I. C. 5611-70—A. & E. 65-23-11, DATED 22ND MARCH 1924.

With a view to spread practical information on agricultural matters among the agricultural classes, articles on certain important subjects connected with agriculture were published during the year in the important Kannada Newspapers in the State.

Government note with satisfaction the keen interest evinced and the assista rendered in various ways, in the work of the Agricultural Department by numer private gentlemen including members of the Agricultural and Experimental Un and by the District Boards of Bangalore, Tumkur, Kolar, Kadur, Shimoga, an Hassan Districts. It is hoped that the remaining two District Boards of Chitaldrug and Mysore would follow the example of the other District Boards and private gentlemen would be forthcoming in still greater numbers to co-operate with and to eventually profit by the work of the Agricultural Department whose main object has been the promotion of Agricultural prosperity in the State.

Government are gratified to note the good work done by the Department and its staff during the year under the able guidance of the Director.

K. V. ANANTARAMAN,
Offg. *Secy. to Govt., Revenue Department.*

To—The Director of Agriculture in Mysore.
The Comptroller to Government.
The Other Heads of Departments.
The Deputy Commissioners of Districts.
PRESS TABLE.

EXD.—P. S. R. N.

W D 1901—GPB—1055—11-4-24

REPORT OF THE DEPARTMENT OF AGRICULTURE IN MYSORE FOR THE YEAR ENDING 30TH JUNE 1923.

PART I.

1. *Charge.*—Dr. Leslie C. Coleman continued to be at the head of the Agricultural, Civil Veterinary and Sericultural Departments till April 4, 1923, when he proceeded on combined leave for eight months. I was appointed to officiate as Director of Agriculture during this period in Government Order No. 4586—C. B. 201-22-6, dated 14th March 1923. As Dr. Coleman was permitted to prefix the Easter Holidays to his leave, I assumed charge of these departments on the afternoon of 28th March 1923.

2. *Staff.*—Passing orders on the recommendations of the Special Finance Committee, the Government abolished the post of the Chemist, Agricultural and Geological Departments, and appointed me Headquarters Assistant to the Director of Agriculture in Government Order No. L. 2397-458—A and E 51-22-1, of 14th September 1922. Dr. M. K. Venkata Rao having secured his Doctorate in the California University, returned to duty on 6th October 1922. He was in charge of the Hebbal Farm and the Agricultural School during the absence of Mr. Kurpad on leave from 15th November 1922 to 15th May 1923. He was appointed to act as Headquarters Assistant from 16th May 1923 during my employment on other duty in Government Order No. L. 8407—A. & E. 9-22-13, dated 30th June 1923.

3. *Tours.*—Dr. Coleman was on tour for 101 days during the year under report. He visited, on request, the Sandal areas of Aiyur and Jowlagiri in connection with the investigation of Spike. I was absent from headquarters for 34 days on inspection work.

4. *Meetings attended.*—Dr. Coleman attended six meetings of the University Council at Mysore and one meeting of the Faculty of Agriculture at Madras. He presided at a meeting of the District Board at Chitaldrug in March 1923. He also attended meetings of the Amrut Mahal Kaval Committee, the Sisal Hemp Committee and the Economic Development Board and presided over that of the Agricultural and Experimental Union.

I presided at the Agricultural Section of the District Conferences of Kadur and Tumkur. I attended the Local Self Government Conference in Bangalore and the Birthday Session of the Representative Assembly at Mysore. Other meetings like those of the Amrut Mahal Kaval Committee and the Agricultural School Board were also attended. I also appeared before the Hon. Mr. Samaldas's Committee on Co-operation in June.

The Annual Departmental Conference, over which I presided, was held on May 28th and the two succeeding days. Such of the officers of the Agricultural, Civil Veterinary and Sericultural Departments as could leave their work attended. Work done during the past year and that proposed to be done during the current year were discussed in the Conference. A full report of the Proceedings was printed and issued about the middle of June last.

5. *Inspections.*—Dr. Coleman inspected the Agricultural Depots at Hassan, Hole-Narsipur, Maddur, Channapatna and Koppa and conducted the annual inspections of the Hebbal, Babbur, Marthur and Nagenhalli Farms and of the offices of the Deputy and Assistant Directors of Agriculture. The Sri Krishnarajendra Vyavasaya Dharma Patasala at Chikkanhalli, the Rayankere Palace Dairy Farm, the Sisal Hemp Estate at Fraserpet and the Cotton plot at Banavar were visited by him. The Veterinary Hospitals at Nagamangala, Hassan, Saklespur, Shimoga and Chitaldrug and the Sericultural institutions at Kunigal, Hole-Narsipur, and Channapatna and the Silk Filature at Mysore were also inspected.

I conducted the annual inspection of the Director's Office, the offices of the Scientific Section and the Central Implement Depot in October 1922.

The institutions inspected by me are as given below:—

Agricultural Department.—Agricultural depots at Kolar, Hassan, Koppa, hikmagalur, Channagiri, Chitaldrug, Tumkur and Mysore, Babbur, Nagenahalli and Yellachalli Farms and Krishnarajendra Vyavasaya Dharma Patasala at Chikkenahalli. The Rayankere (Palace) Dairy Farm was also visited.

Veterinary Department.—The Veterinary Hospitals at Kolar, Mysore, Hassan, Saklespur, Chitaldrug, Chikmagalur and Tumkur.

Sericultural Department.—The Farms at Kolar, Sidlaghatta, Hindiganal, Mysore, Channapatna and Kunigal and the Filature at Mysore.

6. *Leave.*—The following statement shows the leave sanctioned and availed of by the officers of the Department during the year:—

(1) Mr. G. S. Kurpad, Vice Principal, combined leave from 15th November 1922 to 15th May 1923.
(2) Mr. N. Sampath Iyengar, privilege leave from 17th April 1923 to 17th July 1923.
(3) Mr. K. Bhima Rao, privilege leave from 7th June 1923 to 16th July 1923.
(4) Mr. M. J. Narasimhan, privilege leave for 15 days from 31st May 1923.
(5) Mr. E. S. Ramaswami Iyer, Office Manager, combined leave from 12th May 1922 to 6th September 1922 and privilege leave for 14 days from 6th March 1923.
(6) Mr. M. Ranganayakulu Naidu, one month and 10 days' privilege leave from 1st July 1922.
(7) Mr. V. N. Ranganatha Rao, privilege leave for one month from 9th June 1923.

7. *Office.*—As the Disposal Number System is at present in use, it is not very easy to give the number of inward and outward letters. But if I may judge from my experience in the office, the work has increased enormously and is fast outrunning the capacity of the existing office staff to accomplish. The ministerial establishment, in some sections at least, requires early strengthening.

8. *Library.*—The total number of works in the Library now is about 12,000 including bulletins on the various subjects relating to Agriculture. A catalogue of books classified according to the decimal system is in active preparation and will soon be ready for the press. The classification of the bulletins is a long and arduous task and will be undertaken after the book catalogue is ready.

The accessions to the Library during the year were:—

Periodicals	1,377
Bulletins	1,184
Reports	273
Books purchased	11
Volumes bound	194
Total ...	3,039

The number of periodicals received in the Library was 88 as stated below:—

By subscription	51
By exchange	35
By presentation by Dr. Coleman	1
By supply from Government	1
Total ...	88

Two hundred and twenty-eight books were lent out during the year and 710 periodicals were circulated among the officers of the Department.

9. One of the chief obstacles to a more extensive use of the facilities afforded by the Library and Reading room by the public is, I believe, the lack of adequate accommodation. This matter deserves very early consideration.

10. With a view to diffuse practical information on agricultural matters among the agricultural classes, arrangements were made for the periodical publication of articles in the important Kannada papers of the State. The following were contributed and have appeared in the papers during the year:—

(1) A new variety of ragi, evolved in the Mysore State.
(2) A serious pest of tobacco and its control.
(3) Cotton crop and its improvement.
(4) Kamblihulas that destroy the crops and the method of controlling them.
(5) Disease-free silk worm eggs.
(6) Manures for sugarcane.
(7) The new model plough constructed at the Hebbal Experimental Station.
(8) The supply of fodder.

(9) Development of cotton cultivation.
(10) Improvement of sheep.
(11) Mercury as an insecticide, the truth of a popular superstition.
(12) Koleroga of areca palm and its remedy.
(13) How the Agricultural Department conducts experiments.
(14) Dairying in Mysore.

11. The following is a list of the publications issued from the Department during the year under report :—

(1) Agricultural Calendar (English and Kannada) for 1923.
(2) Agricultural School Calendar (English) for 1923–24.
(3) Report of the Eighth Annual Conference of the Officers of the Agricultural Department held in May 1923.
(4) Bulletin No. 5 (English) Mycological Series Black Rot or Koleroga of Coffee in Mysore.
(5) Bulletin No. 7 (English) Entomological Series. The Function of the Prothoracic Plate in Mylabrid (Bruchid) Larvæ.
(6) Revised and enlarged edition of Circular No. 30 (English). A catalogue of books under Authors' names and subject heads, available for lending from the Central Library of the Department of Agriculture.
(7) Circular No. 34 (English and Kannada) Pest Act.
(8) Circular No. 35 (English and Kannada) Ragi (Eleusine Corocana) varietal tests.
(9) Circular No. 36 (English and Kannada) Groundnut (Arachis Hypogeoe) Trials.
(10) Circular No. 37 (English and Kannada) Castor (Ricinus Communis) Trials.
(11) Circular No. 38 (English and Kannada) Sugarcane Varietal Tests.

Chemical Section.

12. As details regarding the work done in the various branches of the Department will be published in full in the reports of the various sections in the second part of the Report, it will be necessary to refer here only to the more important of the results obtained.

13. *Geological Work.*—Out of the two Assistant Chemists that have been working in this Laboratory, Government, as a measure of retrenchment, retained one for the Geological Department and transferred the other to the Bhadravati Iron Works, but directed that the latter should continue to work here until such time as accommodation could be found for him at Bhadravati. One hundred and seventy-three complete analyses involving 1128 separate determinations have been made by these two officers for the two departments during the year.

14. *Pot Cultures.*—In the field of agricultural chemistry, pot culture experiments have been continued mainly on the lines of last year. The results obtained as regards the availability of phosphatic and nitrogenous manures and conditions influencing it in red soils with ragi and jola as trial crops were generally in agreement with those of last year. Superphosphate generally gave better results than other phosphatic manures and the use of ammonium sulphate in conjunction was found to increase the availability of the phosphate not only in the manure but also in the soil. As regards bone-meal, its utilisation was favourably influenced in the case of ragi by the addition of ammonium sulphate or castor cake. The importance of these experiments lies in the fact that if a simple way could be found to render the phosphorus in the insoluble phosphatic manures more readily available, the scope for the use of these cheaper manures in agriculture would be extended. The response to nitrogenous manures alone has been very good and of the manures of this class used, ammonium sulphate, dried blood, and castor and groundnut cakes have given the best results. In similar experiments made with reference to paddy on a heavy clay soil the largest crop was obtained by the use of ammonium sulphate and superphosphate.

15. *Field Experiments.*—Work so far done on the manurial requirements of areca indicates that this crop requires nitrogenous, phosphatic and potash manures and that by suitable manuring, the yield could be materially increased. On soils similar to those on the Babbur Farm, sugarcane seems to require nitrogen, phosphoric acid and lime, while on soil of the type of that in Marthur this crop has been found to respond best to nitrogen applied in the form of cake. Ammonium sulphate was found to influence the tiflering of cane favourably on the Hebbal Farm.

16. *Feeding Experiments.*—Experiments in this connection have been in progress on the Rayankere Dairy Farm for the last two years. A mixed ration of

wheat bran and groundnut cake has been found to be better than a pure ration of bran or cake alone as on it young stock put on weight rapidly. Indications have also been obtained that heifers arrive at maturity earlier on this ration. Experiments directed towards finding out the influence of various rations on the quantity and quality of milk yielded by milch cattle have not yet given any definite results.

17. *Spike on Sandal.*—In view of the importance of the investigation of this disease, Government have, in their Order No. I. C. 6545-7—Ft. 238-22-3 of 26th April 1923, extended the term of appointment of the Special Senior Chemist by three years.

Work done during the year in this connection has shown that the diastatic activity in spiked leaf was about one-half that of healthy leaf. This indicates that the accumulation of starch which is a prominent symptom in spike may be due to defective translocation, rather than to increased formation of starch. That the assimilation of carbon dioxide has been found to be less in the spiked than in the healthy leaf also seems to lend some support to this view. The analyses of oils obtained from wood of healthy and spiked sandal trees have thrown no light on the nature of the disease.

Mycological Section.

18. *Koleroga.*—The incidence of Koleroga was rather severe during the year and spraying could not be done to the extent necessary on account of the continuous rainfall during the latter part of the monsoon and the want of the Holder sprayers, which did not arrive in time from Germany. About 1,200 acres were however sprayed, which represents an increase of 450 acres over the area sprayed last year. The efficacy of spraying against Koleroga attracted the notice of the agriculturists of South Canara who, on their representation, have been supplied with the necessary apparatus and chemicals to the value of Rs. 1,000 this year with the consent of the Madras Agricultural Department. That spraying as a means of combating Koleroga has met with popular approval may be gathered from the fact that 380 sprayers have been sold during the present season. This number has by no means satisfied the demand and a further consignment of 200 is expected shortly. Field trials have shown that the spray mixture with casein as adhesive while being cheaper is just as effective as that prepared with resin. The Agumbe experimental garden remained free from Koleroga this year also which is the ninth after spraying was discontinued. That the disease seems to be slowly moving in the direction of Kigga and Kalasa where it has heretofore not made its appearance in spite of the heavy rainfall in that locality is a disquieting feature which may be mentioned here.

19. *Coffee Diseases.*—The hibernating stage of the Black Rot of coffee was found and a bulletin on this disease was issued during the year. Work done so far in connection with the Die-back of coffee has only given negative results. It is proposed to start systematic work in a few areas this year with a view to find out some means of checking the disease.

Smut on Ragi.—Work done in connection with this disease has yielded no definite results but the indications are unfortunately that it is not likely to be amenable to control as easily as smut on jola.

20. *Spike on Sandal.*—A further step in the investigation of this obscure disease may be recorded. Clear proof has for the first time been obtained during the year that one of the ways in which spike is propagated in nature is by means of root connections. A large number of specimens of spike were examined for the Madras Forest Department.

21. Among results of other miscellaneous work done in this Section may be mentioned that spraying with Bordeaux mixture with casein as adhesive was found effective against the Grape vine Mildew.

Entomological Section.

22. *Kamblihula*—The campaign against this pest (amsacta albistriga) was conducted successfully in parts of Shimoga, and Chitaldrug Districts, moths

representing about 135 million caterpillars having been destroyed. Raiyats in the first two districts being familiar with the control methods for the last ten years, it was considered advisable to transfer the activities of the department in this direction to portions of the Kolar District where the pest has assumed serious proportions of late. A comparatively large area in this district has accordingly been declared under the Pest Act and arrangements for an organised campaign have been completed.

23. *Sugarcane borer.*—The simple method of controlling this pest referred to in the report for last year by trapping the moths in heaps of cane trash was tried on a large scale this year on the Babbur Farm with satisfactory results. Only nine heaps were put out per acre and it was found that two boys could comfortably go over 20 acres. The cost of the remedial measures works out at less than Rs. 2 per acre.

Other Pests.—Work on mango-hoppers (Idiocerus spp.) has been continued but the quest for a remedy simpler than spraying has not yet met with success. The treatment of manure pits with lead arsenate with a view to control the Rhinoceros Beetle (Oryctes rhinoceros) not being entirely successful, the problem is being attacked from another direction. The popular belief that metallic mercury has decided insecticidal properties has, by the work in this Section, been shown to be scientifically correct. The Coffee Borer, the Castor Semilooper and the Lime-tree Borer have also received attention during the year.

24. Two new pests have been reported. The first is a caterpillar infesting cardamoms in parts of Saklespur and Mudgere Taluks. The other is a pest said to destroy young shoots of Ficus trees in Turvekere.

Botanical Section.

The work of the Botanical Section on the Hebbal Farm was as in previous years mainly concerned with breeding work on ragi, sugarcane and groundnut.

25. *Ragi.*—Though in H22 we have found a variety of ragi which is suitable for most ragi growing areas, the search for still better varieties has not been discontinued. Some varieties have been found which yield more heavily than H22, some that ripen earlier and some that are more resistant to drought. These are being grown on larger plots to secure sufficient seed for distribution on a larger scale. A few varieties suitable for growing under irrigation have been found which deserve further trial. Nearly a hundred individual plant selections of *kar* ragi were collected by this Section, but no progress could be made in this work for want of a suitable place to test these. The provision of suitable land in a typical *kar* area deserves early attention. Hybridisation work with this crop has also been continued during the year and promises to give valuable results.

26. *Sugar cane.*—H. M. 544 continues to grow in popularity and may now be said to have found its way into almost all the important cane-growing areas in the State. H. M. 320 is another cane which is found to be free from some defects which H. M. 544 has sometimes been reported to suffer from. It is a cane with a medium hard rind, not subject to the grass like growth one occasionally hears about with reference to H. M. 544 on poor soils. It tillers freely and produces good jaggery. H. M. 312 and H. M. 600 have proved successful on the Marthur Farm. H. M. 544 and P. O. J. 33a have displaced Red Mauritius on the Babbur Farm and the P. O. J. 33a seems in its turn likely to be replaced by H. M. 602.

27. *Groundnut.*—The Hebbal hybrid groundnut did well last season and has again been sown for securing seed for distribution for trial. Hybridisation work has been continued in the hope that varieties may be obtained which shall combine the desirable qualities of the parents.

28. *Potatoes.*—Dr. Coleman observed potato flowering freely near Arkalgud in 1922 and further observation showed that in the neighbourhood of Hebbal the local potato not only flowered but also set fruit containing healthy seed. Out of about 9,000 potato seedlings raised and studied last season about 5,000 plants have been planted this season. It is possible that from this stock, some varieties possessing immunity from the dreaded "Ring Disease" and other desirable characters may be obtained.

29. *Cotton.*—On the Babbur Farm hybridisation work on the Sannahatti and other indigenous cottons and selection work on Cambodia and Dharwar American cottons has been continued. Seed of Selection 69 was distributed on a fairly large scale among raiyats in suitable areas and was found to give a higher yield than the local cotton. The superiority in quality and ginning percentage has also been kept up.

The Experimental Farms.

30. *The Hebbal Farm.*—The work on this Farm was on the same general lines as in previous years. Some experiments however which had given definite results were discontinued and fresh ones started.

In the varietal tests with sugarcane both H. M. 544 and H. M. 320 have done better than Red Mauritius which was used as check. A space of 3 feet between the rows in planting has been found to be more advantageous than one of 2 feet or 4 feet. The varieties have this year been planted out on a new plan to eliminate as far as possible variations due to the soil.

In the comparative test of ragi varieties, H_{22} fared badly during the year while two other varieties H_3 and H_{32} have given good yields. The application of castor cake or ammonium sulphate has distinctly increased the yield of grain and straw while the addition of potash has depressed it.

31. *The Babbur Farm.*—As usual the main crops on the dry land were Sannahatti and Bilijola. Selection 69 cotton produced on this Farm did fairly well. With regard to sugarcane, Dr. Coleman's expectations have been fulfilled. The crop was a very good one, the yield being 24·4 tons per acre on an average though it went up to 40 tons per acre on some plots with favourable situation. The jaggery produced from 13¾ acres which was the area under cane during the year under report has exceeded the yield from the 25 acres which were planted to cane during 1921-22. Cambodia cotton was the other important crop in the wet area. Past experience with regard to this crop indicates that sowing somewhat late gives favourable results in cotton grown under irrigation.

An area of about 7¾ acres was put under plantains during the year. Poovan, Rasatale, Mauritius and a variety intended for use green as a vegetable were used for the test. In all these varieties, except the first one the bunches were found to rot. The cause of this is under investigation. The planting of cocoanuts on this plot was completed.

The Farm was visited by the Dewan during the year.

32. *The Marthur Farm.*—Among the sugarcane varieties tried on the Farm H. M. 312 appears to be best suited for conditions similar to those prevailing on the Farm. Experimental work with regard to arecanut shows that the prospects for increasing the yield by a suitable system of manuring are bright. Ragi did not do well during the year on account of seasonal conditions. Though yields from all the varieties tested were poor, M. M. 1 ragi produced more grain than the others.

33. *The Nagenhalli Farm.*—The total area under cultivation, both dry and wet, during the year was 43 acres, sugarcane and paddy being the crops experimented with in the wet area, jola, horsegram and castor on the dry.

The results obtained this year with regard to sugarcane cannot be considered conclusive as the crop suffered from various causes one of which was a check in its initial stages due to want of irrigation water. During this calendar year also, the supply in the low level channel failed and the young crop in the current season has suffered seriously in consequence. This question has been taken up with the Special Officer of the Krishnaraja Sagara Works, with whose assistance, I hope that permanent arrangements will be made which will ensure continuous irrigation in case the usual supply from the low level channel fails.

34. Considerable distribution of seed of various kinds has taken place from all the farms. The sphere of influence of the Farms over agricultural practices in their neighbourhood is undoubtedly extending year after year.

Agricultural Education.

35. *The Hebbal School.*—The Diploma examination was held for the first time in May 1923 after the course was extended to three years. Thirteen students appeared for the final examination, all of whom were declared to have passed by a Board of Examiners, which included Mr. D. Balakrishnamurthy of the Coimbatore Agricultural College, Mr. E. J. Bruen of the Bombay Agricultural Department and Mr. E. K. Ramaswami of the local Engineering College, as outside Examiners. Three of these students having obtained more than 60 per cent of the maximum number of marks allotted were declared to have passed 'with distinction.' The Diplomas and prizes were presented to the successful candidates by Dr. M. O. Forster, F.R.S., Director of the Indian Institute of Science, on May 30, 1923.

The School Hostel is now being managed by the students themselves. Care is taken to see that education on the physical side is not neglected and the students are being encouraged to interest themselves, without detriment to their studies, in social work, the scout movement, debating society and such other pursuits calculated to enhance their value as citizens of the State.

36. *The Sri Krishnarajendra Vyavasaya Dharma Patasala, Chikkanahalli.*—This school improved in status considerably during the year. The building and 6½ acres of land were formally handed over to Government and the institution passed completely under Government management. His Highness the Maharaja graciously permitted the school to be named after him and the Dewan of Mysore kindly unveiled the marble tablet bearing the new name on 23rd August 1922. The school has undoubtedly been very useful in the past and by extending the course and modifying it in a suitable manner, its usefulness could be greatly increased. But owing to present financial considerations, proposals submitted in this connection were not sanctioned.

There were twelve students in the school. All of them were declared after an examination eligible for the certificates which were presented to them by the President of the School. The students engaged actively in the usual experimental and demonstration work but were deprived for want of funds of the annual excursion and the carpentry and smithy experience, advantages which students in previous years have enjoyed.

Agricultural Engineering.

37. The main item of work done in this section during the year was in connection with the new plough. The various reports received about the work of the twenty trial ploughs referred to in last year's report were carefully studied and some minor alterations were introduced into the design of the plough. The necessary specifications were drawn up and blue prints prepared and sent to Messrs. Ransomes Sims and Jeffries of England.

38. The Agricultural Engineer's work has as heretofore chiefly consisted in teaching in the Hebbal School, supervision of the Farm machinery and workshop and construction and supervision of buildings, etc., for the Agricultural and Sericultural Departments. As provision for additional establishment has been made for this section as per Government Order No. L. 8389—A. & E. 152-22-3, dated 29th June 1923, the Agricultural Engineer will hereafter be able to devote more time to the investigation of problems more intimately connected with the advancement of agriculture in the State.

The Live Stock Section.

39. *Draught Cattle.*—Very little was done during the year towards the improvement of draught cattle though it is a matter of great importance from an agricultural standpoint. Five bulls and one buffalo bull were added to the number already maintained conjointly with the various District Boards and three subventions were granted for the maintenance of approved breeding bulls. This work can be developed only when we have a breeding herd of our own.

40. *Dairying.*—The strength of the Hebbal herd was 39. Ten cows were in milk throughout the year and the average milk yield was 4·4 which is ·4 less than

that of the previous year. These were fed on ensilage which cost Rs. 14-7-4 per ton to prepare.

41. *Palace Dairy Farm, Rayankere.*—By gracious permission of His Highness the Maharaja, the Live Stock Expert continued to hold the charge of the Palace Dairy Farm during the year. The strength of the herd was 136 of which 93 were cows. The average daily milk production per head was 4·2 which is low. This is due to the fact that low producers have not yet been entirely eliminated from the herd.

In addition to the two Holstein bulls acquired during the previous year, a third Holstein bull was imported in January 1923. The number of half-bred Holstein calves born on the Farm up to the end of the official year was 60 of which 26 were bull calves. These calves weighed on an average 5 lbs. more than the Ayrshire half breds at birth and are making good growth.

A series of feeding experiments is being conducted on this farm in co-operation with the Chemical Section to determine the effect of various feeding stuffs on the development of young stock, the result of which has already been briefly indicated elsewhere in this report. Fodder crops were grown in excess of the normal annual requirements of the Farm, so that about 250 tons of ensilage and 30 tons of hay could be set apart for emergencies. The fodder crops grown were chiefly jola, cowpea and sunflower.

42. *Sheep-Breeding.*—Sheep are maintained at Yellachihalli and Hebbal and the strength of the flocks in the two places is not constant as it is necessary to transfer sheep from one flock to the other from time to time. The total strength of the two flocks was 462 of which 287 were ewes and 5 merino rams. Fifty-two ewes were purchased from Poona and added to the flock, as these have a better fleece than the Mysore sheep. A hundred and forty Merino hybrid, 19 country bred, and 5 three-quarter bred Merino lambs were born during the year. In the case of the last, the improvement in wool over that of half-breds is quite noticeable.

43. A good deal of demonstration work has been done, as a result of which 620 sheep were clipped and 3,404 sheep dipped in 23 villages during the year. Owing to limitations of staff available, this work was almost entirely confined to the Kolar District, where it has created an interest in the improvement of the sheep breeding industry. A Sheep Breeders' Association was formed in January and had seventy members, all actively engaged in the industry, on its rolls by the end of the official year. This Association receives a subvention 67-8-0 from Government. The District Board have also recently resolved to maintain a Merino ram of their own for their flock.

District Work.

44. *Seasonal Conditions.*—The early rains were generally favourable throughout and the agricultural season except in certain localities may be said to be fair although later rains proved rather disappointing. The yield of the *kar* crops was normal. The *hain* crops suffered somewhat in the early stages but recovered later and the yields were good. The exceptions were Shimoga and Shikarpur Taluks of the Shimoga District, Gubbi, Tiptur, Chiknayakanhalli, Sira and Maddagiri Taluks of the Tumkur District and Goribidnur and Mulbagal Taluks of the Kolar District where the want of timely rains was severely felt. Very little *Karthik* paddy was sown under tanks and sugarcane suffered badly. The North-East monsoon was good and brought in a plentiful supply of water to the tanks, which helped sugarcane greatly and led to large areas under tanks being put down to *Vaisaki* paddy. Prices of agricultural produce were lower than in the previous year; that of jaggery in particular went down considerably, a fact which must have reduced the area under this crop.

45. The want of the later rains in the areas mentioned above caused great anxiety and a serious scarcity of fodder was apprehended. With a view to afford what relief was possible under the circumstances, a large quantity of jola was procured and supplied promptly chiefly in the Maddagiri Taluk, the departmental motor lorry being freely used for the purpose of quick transport. The raiyats were

advised to sow this on all types of land, the idea being that in cases where conditions were not favourable for the setting of grain, fodder at least would be produced. On suitable soils, yields of 5 to 8 pallas have been reported; on ordinary red soils as a dry land crop, the grain was negligible but the fodder was much appreciated. As the previous paddy crop in these parts was more or less a failure, no seed was locally available and the distribution of seed paddy also which the department organised at this time supplied a keenly felt want.

46. The district work has been carried on on much the same lines as heretofore, but has undergone considerable development during the year. It has related to the demonstration of improved implements and improved methods of cultivation, introduction and spread of new crops and improved seed, use of manures, inspection of estates and the giving of advice on agricultural matters. As full details and statistics will be available to those interested, in the reports of the two Divisions which will be printed as accompaniments to this Report, only the important features will be referred to here.

47. The distribution of improved implements shows progress, but there is yet a very large section of the agricultural population which is not using them. The chief cause that operates against their general adoption is high initial cost of the implements themselves and more than this, the high cost of replacements. This is especially the case with ploughs. The department has, as previously reported, been working for some time past with a view to design a plough which should not be open to these objections. A suitable plough in which the wearing part is a steel bar sharpened at the end was designed and constructed in England to our specifications by Messrs. Ransomes, Sims and Jefferies. Two hundred of these arrived during the year and were put out for sale as the "Mysore Plough." While in England recently, Dr. Coleman arranged to have a flat type of share for this plough sent out for trial. Only one of these was received and the experience with it indicated that though it was liable to get somewhat clogged on heavy sod land, on ordinary land under cultivation, it would be quite as efficient as the standard curved type of share. As the former would be somewhat cheaper in price, some of them have also been ordered for further trial. The Nahan sugarcane mill continues to grow in popularity in spite of its high price, but it has not been possible to get as many as we required from the Factory during recent years. The situation is not likely to improve during the current year either. The whole problem of improved implements which is of paramount importance from an agricultural standpoint can be expected to be solved satisfactorily only when we have an upto date factory which can turn out large numbers of suitable and satisfactory articles at prices within the reach of the ordinary raiyat.

48. Special attention was paid to the development of Agricultural Co-operation during the year. In consultation with the Registrar of Co-operative Societies in Mysore, a scheme was drawn up with a view to interest the Co-operative Credit Societies already in existence in the matter of carrying on the sale of approved implements, seed and manures in addition to their usual banking business. The Societies were to set apart a certain sum from their reserve funds for this business. The Department was to supply them with articles for which there is a steady local demand at concession rates and to help in their popularisation and sale. The retail cash price was to be uniform in the co-operative societies and the departmental depots. All the societies were circularised and 44 societies in the Eastern Division and 14 in the Western Division have entered the scheme under the above conditions. If this work which now takes up a great deal of the time of the executive staff develops successfully, the idea is to transfer it gradually to the co-operative societies to accomplish. The time thus released could be devoted to other important work. The Registrar of Co-operative Societies has been very sympathetic in the matter and to him the thanks of the department are therefore due.

49. Coming to manures, a point worthy of record is the almost phenomenal rapidity with which ammonium sulphate has risen in popular favour. From about three tons sold during the previous year the quantity rose to about 35 tons during the year. As the advantages of oil cake manuring have now become known fairly generally and its use has spread to places where it was unheard of before, the

department has ceased for some time from stocking and directly selling this stuff. About 100 tons were however supplied through the Department, but many times this quantity is known to have been purchased and used by the agriculturists themselves. The use of green manure as a chief source of plant foods has spread to new localities where the practice of growing it was non-existent, and a large quantity of seeds of green manure crops was sold. Manure mixtures for special crops such as paddy, cocoanut, areca, potatoes, etc., of which 40 tons were sold during the year, are becoming increasingly popular. The tendency on the part of the agriculturist to regard artificial manure as something that could be used profitably only in the case of commercial crops seems to be gradually disappearing. The enquiries we are frequently having for a fertilizer mixture for ragi may be taken as evidence of this fact.

50. *Crops.*—H 22 ragi continued to spread during the year not only in places where it had been grown before but also to fresh centres. The area which was sown according to reports received was about 22,500 acres but the Deputy Director estimates that the actual area was somewhere about 90,000 acres. There were about 500 acres under this crop in the Western Division also. H. M. 544 sugarcane distributed in the previous year made excellent growth and yields of as much as 70 tons of cane per acre have been reported from certain places. Its cultivation is extending in suitable tracts of the Western Division also, where, however, Java which is estimated to occupy nearly 1,000, acres is the more popular variety. H. M. 512 and H M. 320 are two other canes which have made some headway. J. 33-a is finding use in the Cheni tracts and Red Mauritius continues to be popular in places with heavy rainfall. Groundnut is a crop that has received a good deal of attention in the Western Division. Spanish and Small Japan are the varieties favoured on account of their erect and early maturing habit, and the Assistant Director estimates that about 10,000 acres in his charge were under this crop. Selection 69 cotton, which is another introduction at the credit of the Department, was grown on about 300 acres in the Chitaldrug and Davangere Ranges and was found to produce higher yields than the local cotton. It also gives finer lint and more of it than the local cotton. Judging from the quantity of seed already distributed the area under this selection during the current year will be much larger. Among introductions on a comparatively limited scale may be mentioned potatoes, turmeric, Pusa-4 and Pusa-12 wheats and two varieties of pepper from the Taliparamba Farm.

The Central Implement Depot.

51. The period for which the Central Implement Depot was sanctioned is due to expire on 9th August 1923 and the Government have been addressed in the matter of its continuance. In view of the very useful and necessary work it is doing, the Depot has to be continued until such time as other reliable agency is found to take this work off the hands of the Department.

52. There is nothing worthy of special mention under this head during the year. No new implement was stocked for sale except the Mysore Plough which has already been referred to. The Kirloskar plough is becoming increasingly popular on the black cotton soils. Ninety-four Kirloskar ploughs were sold during the year as against 85 in the previous year. It must be mentioned, however, that this slight increase cannot be taken as a correct index of its popularity as many more are known to have been purchased through other agents. The demand for the Nahan sugarcane mills could not again be fully met. There was a shortage of shares for the popular Kolar Mission plough which was endeavoured to be met in part by locally made shares.

The total sales during the year under report amounted Rs. 51,177-0-5 as against Rs. 50,508-14-3 during the previous year. Implements of the value of Rs. 136-14-0 were issued under the Hire Purchase System. The receipts amounted to Rs. 61,983-6-7 consisting of Rs. 47,493-0-8 in cash and Rs. 14,490-5-11 by transfer. The cash receipts were proceeds of cash sales, instalments on account of Hire Purchase sales and collections towards old arrears.

53. The following statement shows the expenditure incurred in the purchase of stock and the sources from which it was obtained :—

		Rs	a.	p.
1.	Nahan Foundry, Punjab	19,500	0	0
2.	Central Industrial Workshop, Bangalore	4,568	0	3
3.	Kolar Mission Institute, Kolar	11,615	8	0
4.	Abdul Shukoor Bros., Madras	140	5	6
5.	Burn & Co., Calcutta	103	12	0
6.	Agricultural Engineer, Bangalore	81	14	0
7.	K. K. Abdul Azeez, Iron Merchant, Bangalore	397	0	0
8.	Messrs. Kirloskar Bros., Kirloskarwadi, District Satara ..	5,765	6	9
9.	„ Macbeth Bros., Calcutta	97	6	0
10.	Mysore Metal Industries, Bangalore	318	4	0
11.	Mysore Saw Mills, Mysore	187	8	0
12.	Umapatiappa, Merchant, Davangere	15	0	0
13.	Civil Veterinary Department, Bangalore	22	8	0
	Total ..	42,812	8	6

54. The usual financial statement is printed in the appendix.

55. *The Civil Veterinary and Sericultural Departments.*—These two departments continued to be under the general administrative control of the Director. As separate reports are submitted to the Government by these departments, it will be sufficient to state here that the close association referred to in last year's report as existing between the three departments has continued unimpaired.

Conclusion.

56. The District Boards of Kolar, Bangalore and Tumkur have as in previous years voted sums of money for the award of prizes to those who grew the best crop of H_{22} ragi during the season. The District Boards of Hassan, Shimoga and Kadur have helped the work of the Department, the first by advancing Rs. 2,000 for purchase of seed for distribution and contributing towards the maintenance of a demonstration plot in Hassan on which various crops recommended by the Department were grown on a small scale as an object lesson. The Shimoga and Kadur District Boards have advanced various sums of money to be utilized in pushing on agricultural work in their districts. To these the thanks of the Department are due. The Agricultural and Experimental Union continued to do useful work. Its Journal was issued regularly and was as usual full of information capable of ready practical application. I wish to take this opportunity of expressing my grateful acknowledgments to those members of the Union who have conducted practical trials on behalf of the Department at great trouble and furnished valuable reports of their experience.

57. The gentlemen mentioned in last year's report as having helped the cause of agricultural improvement in the State have continued their good work during the year. Others have joined their ranks during the year under report, and I would like to assure all of them that the Department values their assistance very highly.

58. The report, I believe, shows that there has been an increase all round in the activities of the Department, but there has been no corresponding increase in the strength of the staff or improvement in the pay and prospects of those already in the service. It has meant substantially more work for the existing staff which they have performed loyally and conscientiously. I wish to place on record my high appreciation of the service thus rendered under discouraging conditions and to convey my sincere thanks to the staff of the Department.

H. V. KRISHNAYYA,
Offg. Director of Agriculture.

PORT OF WORK DONE IN THE AGRICULTURAL DEPARTMENT DURING 1922-23.

PART II.

REPORT OF THE AGRICULTURAL CHEMIST FOR 1922-23.

Charge.—I have been in charge of the work on Agricultural Chemistry during the whole of the year as usual. In addition, I have been in charge of the chemical work for the Geological Department as well as the Mysore Iron Works since April 1923.

Staff.—The appointment of Mr. B. Shankara Rao Badami as Senior Assistant Chemist in connection with Spike investigation was sanctioned for three more years in Govt. Order No. I. C. 6545-7—Ft. 238-29-3, dated the 26th April 1923.

Mr. M. C. Ramaswamiengar, one of the three analysts, resigned his appointment from 5th May 1923, and the vacancy so caused has not yet been filled up.

Leave.—Mr. N. Sampatiengar, Senior Assistant Chemist, was on privilege leave for three months from 17th April 1923; Mr. K. Bheema Rao, for one month and eight days from 7th June 1923; Mr. B. Shankara Rao Badami, for 21 days from 21st August 1922, Mr. C. Ellappa Chetty, for one month and 25 days from 8th May 1923 and Mr. M. C. Ramaswamiengar, for one month from 5th April 1923.

Tours.—I was on tour for 41 days inspecting the experiments started on the various farms of the Department and also at Rayankere. Mr. N. Sampatiengar spent 109 days in attending to the work of field experiments. Mr. G. Sundararajiengar, Agricultural Inspector, attached to this section, spent 227 days at Rayankere for conducting feeding experiments, and Mr. S. Ramaswami Sastry, Analyst, spent 7 days at Rayankere in assisting the Agricultural Inspector in charge of the work there. Want of sufficient provision in the budget has been the main hindrance in the way of more extensive touring to study soil conditions and local practices of manuring.

Correspondence.—The number of inward and outward letters during the year were 623 and 735, respectively, of which 274 and 278, respectively, related to the Stores Section and Geological work under the Headquarters Assistant till April 1923.

Potculture Experiments.

1. *Availability of phosphates in red soils.*—This is a repetition of work done in 1921-22 with the following modifications, (*a*) basic slag, monocalcic and tricalcic phosphates were left out of experiment, (*b*) in the pots so made available, jola was sown to get comparative results for studying the availability with ragi and jola grown side by side under identical conditions, and the plan of experiment is briefly as follows:—

Series 1. No phosphate manuring.
Series 2. Manured with superphosphate.
Series 3. Manured with bone-meal.

Each series was subdivided into three groups—(*a*) With no extra nitrogen except what was in the soil, (*b*) with sulphate of ammonia and (*c*) with sulphate of ammonia and sulphate of potash to study the effect of potash on the availability of phosphates.

In all, 72 pots were used for these experiments—36 growing H22 ragi and 36 growing fodder jola.

2. *Availability of bone-meal as influenced by various sources of nitrogen*—(*a*) Sulphate of ammonia as included in the general series, (*b*) dried blood, (*c*) groundnut cake and (*d*) castor cake. In all 24 pots were used for this series of experiments—12 growing ragi and 12 jola.

3. *Effect of sulphate of potash given in three different doses on the availability of bone and superphosphate*—the single dose pots being in the general series for comparison—on the following plan. (*a*) Bone and sulphate of ammonia, (*b*) Super and sulphate of ammonia and (*c*) Super and blood. As only 12 pots were available, only ragi was grown as the experimental crop.

4. *Availability of nitrogenous manures.*—This series was first started in 1920 with ragi as the experimental crop and repeated in 1921 in a different soil and with jola as the experimental crop. As the results of these two years showed certain variations, the experiments were repeated this year by growing jola and ragi simultaneously under similar conditions on the following plan:—

(*a*) No nitrogen, (*b*) with sulphate of ammonia, (*c*) with dried blood, (*d*) with groundnut cake, (*e*) with kurdi or safflower cake and (*f*) with castor cake.

Each of the above series was sub-divided into three groups.—(*a*) no phosphate, (*b*) with super and (*c*) with super and sulphate of potash. For want of a sufficient number of pots for fodder jola being grown, the potash group was left out for the jola crop. In all, 120 pots were used for these experiments—72 for ragi and 48 for jola.

H22 ragi and fodder jola were sown on 1st August 1922. Due to damage of young shoots by rats and squirrels, germination of jola was interfered with to a certain extent and some of the pots had to be resown. The germination of ragi was quite good and uniform. Between 12th and 16th August 1922, ragi was thinned out and only 12 plants left in each pot as usual. Jola plants were reduced to 12 in each pot on 4th August 1922.

In the phosphate series, of those pots which had received no nitrogen, but only phosphates, those manured with bone-meal looked better than the others. This may be due to the effect of small quantities of nitrogen present in bone-meal itself. Of the other pots, in which phosphates and sulphate of ammonia had been used together, those manured with super were the best. Coming now to the pots to which sulphate of potash also had been added, a combination of bone, sulphate of ammonia and sulphate of potash looked very good. On the whole, those pots with sulphate of ammonia, super and sulphate of potash in three doses were the best. Potash given in one single dose seemed to act better than the same given in three doses when bone-meal was used as source of phosphoric acid.

In the nitrogenous series, the plants in those pots manured with super in addition to nitrogenous manures showed a more vigorous growth than those in others; but the effect was more marked in the case of jola than in the case of ragi. Where only nitrogenous manures had been used, pots manured with organic sources of nitrogen, like blood and cakes, looked better than those manured with sulphate of ammonia. After about five or six weeks, a change in favour of the sulphate pots was noticeable and finally the sulphate pots were ahead of the others. This confirms the observations made in previous seasons. Of the three cakes used, kurdi cake did not show its effect on the plants to the same degree as groundnut and castor cakes.

Considerable differences in colour varying from dark rich green to light green mixed with yellow were noticeable according to the way in which the plants had been manured. Those manured with sulphate of ammonia and super had the richest colour, next came those manured with castor cake and super, and the poorest of all, excepting of course the unmanured ones, were those manured with kurdi cake alone. To show the effect of phosphates, the jola plants were photographed on 16th September 1922 and 12th October 1922 and the ragi on 12th October 1922 and notes have been taken for colouring the photographs to show the differences.

About 9th October 1922, part of the jola crop was in short blade, but even on 13th October 1922, none of the plants manured with cakes alone or cake and super was in short blade. After making detailed notes of the time of flowering, the jola crop was harvested on 16th October 1922. It being a fodder crop and also to decrease the work of analysis in the laboratory, the crop was not allowed to form grain.

Among ragi plants, those that had received sulphate of ammonia and super, were the first to flower and this was on 2nd October 1922. A combination of bone-meal and blood does not seem to conduce to early flowering. In fact, those that had received bone as phosphatic manure began to flower gradually after 10th October 1922. Of those that had received only nitrogenous manures in the form of cake, the kurdi cake series was the first to flower on 13th October 1922; then came those with castor cake, and last of all, were those with groundnut cake. The small plants in the unmanured series put forth short and slender earheads with two to four spikes in each. With regard to ripening, those manured with potash in addition to nitrogen and phosphate ripened earlier than others.

The jola crop was harvested on 16th October 1922 and ragi on various dates between the 7th and 27th November 1922. It was found very difficult to keep rats and squirrels from damaging the earheads of ragi. A careful note was made of the number of earheads so damaged in each pot. From data obtained from similarly treated pots, *i.e.*, from the ratio of straw to grain in undamaged pots and from the weight of straw in the damaged ones, the weight of grain in damaged pots was calculated.

Coming now to the first set of experiments dealing with availability of phosphates, it has been found that in two of the three groups, superphosphate has increased the crop more than bone-meal did. It is only in the no-nitrogen group that bone-meal has surpassed superphosphate in increasing the crop and this may be due to the small amount of nitrogen contained in it.

Comparing the two crops ragi and jola with each other, it was found that even when no phosphate had been used, ragi had produced more substance than jola and that the application of phosphates had benefited jola more than ragi. It was only when sulphate of ammonia was applied along with bone meal that ragi was benefited more than jola, but when potash also was used, the effect was reversed. These observations require confirmation and further investigation.

The effects of the addition of the sulphate of ammonia and sulphate of potash on the soil phosphate itself and on the phosphatic manures used, as judged by the increase in crop yields, indicated that an addition of sulphate of ammonia had a beneficial effect on the utilization of soil phosphate as well as superphosphate in case of both ragi and jola. A combination of bone-meal and sulphate of ammonia had increased the crop of ragi only. The addition of potash also had a slightly beneficial effect on the soil phosphate so far as ragi was concerned and a good effect on bone-meal when jola was the crop. In all other cases, the yields had been depressed, and this too requires confirmation and further investigation.

The analytical data to find out the recovery of phosphoric acid from the manures used is not yet completely to hand and so, that point cannot be discussed in this report.

The results of experiments on the decomposition of bone-meal as influenced by various sources of nitrogen indicated that so far as ragi was concerned, ammonium sulphate and castor cake were the two sources of nitrogen which may advantageously be used along with bone-meal. With regard to jola, the differences due to the use of the two sources of nitrogen referred to above were too small. The use of dried blood and groundnut cake had decidedly depressed the yields in case of ragi as well as jola. The investigation will be continued to confirm the results now obtained as well as to find out the reason for the beneficial action of castor cake on the decomposition of bone-meal.

Experiments in Europe on the effect of potash salts on the utilisation of phosphates by crops have shown that in the case of soluble phosphates like superphosphate, it is more advantageous to apply potash manures in small doses at different times than to apply the same in one single dose. These results have been obtained with leguminous crops which need mostly phosphoric acid and potash. Similar experiments conducted here, but with ragi and jola, did not indicate any beneficial action due to application of potash in small and repeated doses. The experiments will be repeated with leguminous crops with a view to find out some means of utilising insoluble phosphates like bone-meal to a greater extent than it is now possible.

The results of the series of experiments on the availability of nitrogenous manures indicated that the addition of nitrogenous manures alone had increased the yields enormously. This is very encouraging as the soil used for these experiments had not received any nitrogenous manures since 1907.

Of the various nitrogenous manures used, it was found that sulphate of ammonia took the lead in all cases except in the case of jola in the pure nitrogen group in which it was slightly behind castor cake. So far as ragi was concerned, dried blood stood next to sulphate of ammonia in all the three groups. Of the oil cakes, groundnut and castor competed with each other very closely in their effect on ragi, whereas, kurdi or safflower cake was found distinctly inferior to either of them. The effects of dried blood and oil cakes on jola did not appear to be so uniform as with ragi.

Coming now to the effect of other manures on the various nitrogenous ones, the results indicated that the addition of other manures, specially phosphates, had had some effect on the utilisation of soil nitrogen itself. Except in the case of kurdi cake, the addition of nitrogenous manures alone to the soil produced heavier yields in the case of ragi than in the case of jola. So, even though the addition of phosphate to the nitrogenous manures used had contributed to an increase of crop, that increase was more marked with jola than with ragi. This seems to indicate that jola responds to phosphate manuring more than ragi does. Much importance cannot be attached to variations in yield of ragi following the application of potash also. For want of pots the comparative series with jola could not be started.

Similar experiments on the availability of nitrogenous manures in a heavy clay soil and with paddy as the experimental crop were started in February 1923. Seedlings of Chintamani sanna bhatta were got from the Hebbal Farm when they were 34 days old and transplanted into the pots on 12th February 1923.

The nitrogenous manures tried were sulphate of ammonia, dried blood, groundnut cake, kurdi cake and castor cake, by themselves and along with phosphates, superphosphate and bone-meal, and potash salts also. The pots that had received superphosphate also along with nitrogenous manures went far ahead of the others in course of time and attracted considerable attention when exhibited at the Bangalore District Conference.

The maximum crop was obtained by the use of sulphate of ammonia and superphosphate. The superphosphate series was harvested 4 weeks earlier than the others. Sulphate of ammonia and dried blood, when used by themselves or in combination with bone-meal, did not bring the crop to form any grain at all. The addition of potash salts to nitrogenous and phosphatic manures did not result in any increase of crop.

Making use of all these indications, field experiments on the manurial requirements of paddy have recently been started on the Hebbal Farm.

The analytical data to calculate the recovery of nitrogen from the manures applied is not yet complete and so cannot be commented upon for the present.

Field experiments.—Manurial requirements of the areca palm :—These experiments started for the first time on the Marthur Farm in December 1920, were continued on the same lines as before. The first crop was harvested in 1921 and the second crop in 1922, and the results of the two crops are as follows :—

Treatment	Yield of dried nuts in lbs. per acre of 400 trees		No. of trees harvested	
	1921	1922	1921	1922
Check Series	620	455	630	658
Crotalaria	550	385	103	162
Cake	730	686	121	131
Ammonium sulphate	787	697	123	132
Cake and Super	650	697	164	190
Ammonium sulphate and super	727	728	153	161
Cake, Super and Potash	948	822	144	166
Ammonium sulphate, Super and Potash ..	803	749	143	161

In 1922, the nuts were not allowed to get over-ripe, but harvested when they were still tender enough and suitable for slicing. Hence the yield is slightly lower than what it would have been if the nuts had been harvested as in previous years. The total yield of dried nuts for the whole garden was 2,700 lbs. or about 96 mds. and fetched a uniform price of Rs. 10 per maund.

The figures indicate that in both the years, the artificial manures have shown their effect on the crop. The substitution of crotalaria for the usual *soppu* applied to the garden has not shown any beneficial effect. The decrease in yield from one year to another has been greatest where no artificial manures were applied.

Coming now to the action of individual manures, the yields indicate distinctly that both nitrogen and potash are needed. In the absence of a series manured only with nitrogen and potash, it is rather difficult to say with any degree of definiteness whether phosphatic manures are required or not. With the figures on hand, one can only say that a combination of all the three kinds of manures had shown the best effect. Even of the combinations under trial, one of cake, super and sulphate of potash has given the maximum yield in both the years.

The application of lime to a part of each series, which could not be carried out till now for want of material, has been done in November 1922 and the results of this will be available only next year. After getting results for one more season, the question of the most economic doses of these artificial manures will have to be taken up.

Manurial requirements of Sugar-cane.—These were started on the Babboor Farm for the first time in 1920-21, and were continued on the same plan as before. The results of three seasons are tabulated here for comparison.

Treatment	Yield of cane in tons per acre					
	Unlimed series			Limed series		
	1921	1922	1923	1921	1922	1923
Check plot	19·6	13·0	24·3	22·3	12·3	24·7
Complete manure	22·0	18·7	31·8	23·5	17·5	33·1
Without Ammonium sulphate ...	23·3	11·5	30·3	22·7	11·6	31·3
Without Super	21·0	14·4	30·4	23·0	14·0	31·4
Without Potash	25·6	16·6	32·6	25·6	14·4	34·5

N.B.—Variety of cane planted—Red Mauritius for 1921 and 1922 and J. 33A 1923 Series.

The three crops harvested till now have been grown on three different sets of plots. During the first two seasons, the whole experimental area was manured uniformly with one ton of groundnut cake per acre and the variety of cane planted was Red Mauritius. For the 1922-23 experiments a green manure crop of sunn-hemp and cow-pea was grown on the field and ploughed in before planting the cane. The usual dose of one ton of oil-cake was also given. Red Mauritius not having been found particularly suited to the tract in which the Farm is situated, J. 33A was used instead for planting.

The artificial manures applied have shown their good effect in all the three seasons. The omission of either nitrogen or phosphoric acid has tended to decrease the crop generally. In two of the years, those plots that did not receive any potash at all have given the highest yields. In the same two years, the limed plots have also given better yields than the unlimed ones.

Taken as a whole, the results of these three years' work indicate that nitrogen, phosphoric acid and lime are needed for sugar-cane on the type of soils on which the experiments were tried at Babboor. When another set of results have been obtained on the same series of plots, the question of actual quantities of sulphate of ammonia and super needed to grow sugar-cane profitably on lands represented by the Babboor Farm will have to be taken up.

Even from a financial standpoint of view, the results of 1923 seem to be satisfactory. The check plots have yielded on an average 24·5 tons of cane or 196 maunds of jaggory per acre, whereas the completely manured plots yielded 32·5 tons of cane or 260 maunds of jaggory. The cost of extra manure applied comes to about Rs. 75 an acre. Adding to this the cost of manufacture of extra 64 maunds of jaggory at As. 6 per maund or Rs. 24, the total expenditure comes to about Rs. 100, and the realisation on 64 maunds of jaggory at Rs. 2½ a maund, amounts to Rs. 160, thus leaving a net profit of about Rs. 60 an acre.

Similar experiments on a slightly modified plan were started on the Marthur Farm also in 1921 and continued in 1922. The trial of potash also had been included in 1921 but discontinued in 1922. The variety used for planting was Red Mauritius and the effect of superphosphate on the cane crop was very marked. Groundnut cake was applied to the whole area at one ton per acre and an extra dose of 625 lbs. per acre to some of the plots in 1922-1923 to compare its effects with the same amount of nitrogen given to the other plots as sulphate of ammonia or nitrate of soda. The results obtained indicate that extra nitrogen given in the form of cake is more beneficial than the same applied in the form of sulphate of ammonia or nitrate of soda. This result remains to be confirmed before the experiments can be modified.

Similar experiments to find out the influence of phosphatic manures applied at the rate of 300 lbs. super phosphate per acre on yield of cane had been started on a fairly large scale on the Hebbal Farm with H. M. 544 and on Ooragahally Estate with local striped cane. The whole area had been manured with one ton of groundnut oil cake and 250 lbs. sulphate of ammonia per acre in addition to green manure at Hebbal and cattle manure at Ooragahally. The results indicated that the local cane responds to phosphatic manuring better than H. M. 544.

Influence of sulphate of ammonia on the tillering of cane.—These experiments started on B Range varietal plot on the Hebbal Farm were continued and the results are as follows:—

Variety	Yield of cane in tons per acre.	
	Cake plot	Sulphate plot
H. M. 320	44·6	45·09
H. M. 332	38·25	43·03
H. M. 313	37·53	42·00
H. M. 553	35·55	39·67
H. M.	34·85	43·15

Varietal tests at Ooragahally.—H. M. 544 was tested against local striped on a large scale. H. M. 544 was grown on an area of 1·5 acres and local striped on an area of 23·44 acres adjoining it. Both varieties received the same treatment with regard to cultivation, manuring, etc. H. M. 544 looked more vigorous than the local striped, but the tonnage proved to be the same from each variety—30 tons of cane to the acre. Extraction tests proved that H. M. 544 gave only 65 per cent and local striped 70 per cent juice. The juice from local striped was richer in composition than that from H. M. 544 containing 20·0 per cent solids as against 18·5 per cent in the latter. The yield of jaggory worked out to 330 maunds per acre from local striped as against 280 from H. M. 544. This indicates that in certain localities at least H. M. 544 is not superior to the local striped cane.

Manurial requirements of paddy.—These were started on the Marthur Farm in 1922 and four series of plots were laid out for the purpose. The variety of paddy experimented with was the local Jaddu. Each manurial treatment has been repeated on three different plots and manures were applied just before the seedlings were transplanted.

The whole series of experiments has been planned to give information on the manurial requirements of paddy in general, on the quantities of nitrogen and phosphoric acid needed and on the relative merits of ammonium sulphate and groundnut cake as sources of nitrogen. The indications from one year's results are that paddy requires both nitrogenous and phosphatic manures, that 100 lbs. ammonium sulphate and 280 lbs. super per acre meet the requirements and that ammonium sulphate is superior to groundnut cake as a source of nitrogen on the type of soil experimented with.

Trial of nitrogenous manures on ragi.—These experiments were started in 1920-21 on the K. Range of the dry area on the Hebbal Farm. H. 22 ragi was sown on 1920-21 and 1922-23, and the manures tried are castor cake and sulphate of ammonia in addition to the usual dose of cattle manure. Each treatment has

been repeated thrice on the plots 1/20 an acre in extent and the average yields are as follows:—

Treatment	Yield in lbs. per acre			
	Grain		Straw	
	1921-22	1922-23	1921-22	1922-23
Only cattle manure	1,087	1,335	1,670	2,145
Do and castor cake	1,816	2,066	3,100	3,033
Do and sulphate of ammonia	1,958	2,060	3,658	2,813

By some mistake, cake and sulphate of ammonia were applied at double the rate intended, in 1920-21. Even with half the dose in 1922-1923, *i.e.*, equivalent to 50 lbs. nitrogen per acre, the yield of grain increased by 50 per cent over the check plot.

Manurial requirements of ragi.—These were started on an odd bit of sloping land in 1922-23 and H. 22 ragi was sown. Each plot is $\frac{1}{80}$ acre in size and each treatment has been repeated thrice on different plots. This being the first year of the experiments and the land also not being uniform, much importance cannot be attached to the results obtained. They can only be taken as indications for further work on land suited for experiments.

Manuring of mulberry.—Experiments in this direction have been started in co-operation with the Department of Sericulture on their Farms at Mysore and Channapatna. The manures under trial are sulphate of ammonia, groundnut cake, honge cake and silk worm droppings. Arrangements have been made to feed different batches of worms on leaves from differently treated plots. Samples of leaves have been collected for analysis as well.

Feeding Experiments.—The first of this series of experiments was started in co-operation with the Live Stock Section on the Rayanakere Dairy Farm in July 1921. Twenty calves were selected for the purpose and divided into two lots of ten animals each. One lot was fed on wheat bran, and the other lot on bran and groundnut cake, coarse fodder such as straw, green grass or silage being the same for all the animals The first period of feeding was closed on 15th October 1921, and the results obtained have been published in detail in Vol. IV, No. 1 of 1922 of the Journal of the Mysore Agricultural and Experimental Union. The work was continued further till January 1923, and the results published in Vol. V, No. 2 of the same Journal in June 1923.

Taking the whole period of experiment into consideration, it was found that the weights of animals in the bran and cake series had increased from 2,294 lbs. to 5,534 lbs. or by 3,240 lbs. whereas that of those in the bran series increased from 2,301 to 5,333 or by 3,032 lbs. This means that the animals fed on bran and cake have put on 208 lbs. more weight than those fed on bran alone. This works out to an extra gain of nearly 7 per cent in weight in favour of animals fed on bran and cake.

It was also found that the maximum increase had taken place between July and October 1921 in the case of animals fed on bran and cake, and between July and October 1922, *i.e.*, exactly one year later in case of animals fed on bran alone. In fact, during the first quarter of experiment, the animals in the bran and cake series had put on 35 per cent more in weight than those fed on bran alone. This difference in gain in favour of animals in bran and cake series went on fluctuating during succeeding quarters till 29-7-1922 when the animals in both the series weighed almost the same, animals of the bran and cake series weighing 4,358 lbs. and those in the bran series weighing 4,361 lbs.

A few days after the first year of experiment was over on 29-7-1922, it was found that the animals in both the series had attained almost the same weight and it was decided to increase the concentrated feeds gradually and see the effect on the further developments of the animals. Ever since the experiment was started on 13-7-1921, the animals had been receiving either 1½ lbs. of bran per head per day or the same amount of bran and one pound of groundnut cake in addition.

At the beginning of the second year, it was decided to increase the bran ration by three ounces per head per day every fortnight till a maximum of three pounds was reached and the cake ration by two ounces till a maximum of two pounds was reached. Feeding according to new rations was started on 5-8-1922 and the maximum was reached on 25-11-1922, and the whole experiment closed on 6-1-1923.

During the period of increased rations, the weight of animals in the bran and cake series increased from 4,358 lbs. to 5,534 lbs. *i.e.*, by 1,176 lbs. whereas that of those in the bran series increased from 4,361 lbs. to 5,333 lbs. *i.e.*, by 972 lbs. This means that the animals in the bran and cake series put on 204 lbs. more weight than those in the bran series, which works out to an extra increase of nearly 21 per cent.

This increase in weight may not entirely be due to feeding alone, for, of the five heifers in each series, all of them in the bran and cake series had been covered between 15-8-1922 and 19-11-1922, whereas only two animals of the bran series had been covered during the same period. One of the objects of continuing these experiments for more than one year was to ascertain if feeding with oil-cake has any special influence on the maturity of the heifers and in hastening them in breeding, and the fact that all the heifers in the bran and cake series were covered earlier than those in the bran series seems to indicate a tendency in favour of cake feeding.

Nothing definite was known as to the age of these animals and their breeding. To find out the influence of these two factors, a new series of experiments on a similar plan was started on 17-12-1921 and closed on 15-7-1922. Each series had been sub-divided into five groups. As far as possible, corresponding groups in each series contained animals of the same age, breed and sex. Whenever it was not found possible to group them as above, a variation either in sex or breed of the animal had been introduced. This enables not only a comparison between the two series separately, but also animals of the same breed and age but of opposite sexes, and animals of the same age and sex, but of different breeds.

With regard to amount of concentrated feeds given to the animals, groups 1 to 3 in the bran series received 1½ lbs. bran per head per day and groups 4 to 5 containing younger animals only ¾ lb. bran. Of those in the bran and cake series, groups 1 to 3 received 1½ lbs. cake and groups 4 and 5, ¾ lb. cake in addition to bran. Besides, the heifer calves in both the series were given a small quantity of milk.

During the period of experiments, the animals in the bran series put on 1,652 lbs. in weight which works out to an increase of 86 per cent. During the same period of about 7 months, the animals in the bran and cake series put on 1,918 lbs. in weight and this works out to an increase of 107 per cent. This shows that feeding with cake in addition to bran, enables the animals to put on nearly 21 per cent more weight than they would have done on a pure bran ration. Judging from the periodical increase in weight, it was found that except during the periods January-February and May-June, there had been a continuous improvement and the maximum increase in both the series had been reached in June-July.

Coming now to the various groups in each series, it was found that the youngest of the lot did not show any appreciable difference in weight put on due to cake feeding. Animals in group 1 to 3 were all more than three months old when the experiment was started. During the period of seven months, those animals in the cake series increased from 1,372 lbs. to 2,232 lbs. or by 860 lbs. whereas those in the cake series from 1,346 lbs. to 2,529 lbs. or by 1,183 lbs. This shows that cake feeding enabled the animals to put on 323 lbs. or 37 per cent more weight than under bran feeding alone. In a previous experiment with animals born in 1920 and more than 6 months old when the experiment was started, almost the same increase in weight, 35 per cent, due to cake feeding in addition to bran during the first three months of feeding, had been obtained.

Owing to certain economic reasons, the Live Stock Section decided to sell away all the bull calves, and so the heifers remaining were regrouped and a new series of experiments—cake feeding *vs* bran and cake feeding—was started on 5th August 1922. The amount of concentrated rations was based on protein content, and each animal was given at the start, either 1½ lbs. bran with 1 lb. cake per day or only 1½ lbs. cake. The bran ration in the bran series was increased by 3 ounces every fortnight and the cake ration in the other series by 1 ounce till a maximum ration of 3 lbs. bran and 1 lb. cake or 2 lbs. cake was reached on 25th November 1922.

It was found that during the period of a little over 4 months ending with 9th December 1922, *i.e.*, a fortnight after the maximum of the rations was reached, the 11 animals fed on bran and cake had increased from 2,315 to 3,766 lbs. *i.e.*, by 1,451 lbs. or 63 per cent, whereas the 11 animals fed on cake alone containing the same amount of proteins had increased from 2,311 lbs. to 3,404 lbs. or by 1,093 lbs. or 47 per cent. This shows that feeding with bran and cake enabled the animals to put on nearly 33 per cent more weight than it would have been possible for them with pure cake ration.

The results of all these experiments show that a mixed ration of bran and cake is better than one either of pure bran or pure cake. Bran by itself is too bulky to be fed in quantities enough to supply the needed amount of protein and cake by itself is too concentrated and does not provide the necessary bulk. Whether it is possible to replace wheat bran by a cheaper and equally good material is to be tried next.

The increase in weight of individual animals under the same system of feeding is not uniform. For instance, in the bran and cake series one animal had increased from 102 lbs. to 175 lbs. *i.e.*, by nearly 75 per cent, whereas another had increased from 272 to 408 lbs. *i.e.*, only by 50 per cent. Such variations have been found in all the series of experiments conducted.

A similar series of experiments was started with younger animals born in 1922. These were started with a concentrated feed ration of 12 ounces bran and 8 ounces cake or only 12 ounces of cake, the rations being gradually increased till the bran and cake series reached a maximum of 3 lbs. bran and 1 lb. cake and the cake series a maximum of 2 lbs. cake. The feeding was started on 5th August 1922 and the maximum rations were reached on 20th January 1923.

During the period ending with 3rd February 1923, the four animals in the bran and cake series had risen from 527 lbs. to 1,149 lbs. or by 622 lbs. or 118 per cent. During the same period, the four animals in the cake series had increased from 527 lbs. to 1,106 lbs. or by 111 per cent. The difference between the two is not much, and the results are very similar to those obtained in groups 4 and 5 of calves in previous experiment. The tendency as indicated by all these experiments seems to be in favour of animals being given concentrated feeds beyond a certain age which seems to be beyond 6 months after birth. In fact, the best and the quickest results have been obtained with calves which seemed to be more than 6 months old when taken on for experiments. The results of all the above experiments have been published in Volume V, No. 2 of the Journal of the Mysore Agricultural and Experimental Union.

In addition to experiments with calves described and discussed above, experiments with milch cows to find out the influence of wheat bran, rice bran, and dhal husk on the quantity and quality of milk were started in July 1922. Twenty Sindhi cows were selected for the purpose and divided into four groups of five cows each taking into consideration the previous history of each animal with regard to date of calving, period of lactation, and daily yield of milk. From previous months' records, the average daily milk yield of each group was calculated at 58 lbs. Before the actual differential feeding began, all the animals passed through a preparatory period of 11 days from 3rd July 1922 on a ration consisting of groundnut cake, wheat bran and dhal husk. The average daily milk yield of the different groups during this period was as follows:—

Group 1	49·4 lbs.	Group 2	53·2 lbs.
Group 3	51·2 lbs.	Group 4	44·2 lbs.

This certainly indicated that some regrouping was desirable, but as such a process would have disturbed the other factors on which the grouping was based, the animals were not disturbed in their groups with the idea of working out a factor for correction, if necessary. Instead of the milk yield, if the quantity of butter-fat contained in the total milk during the period of ten days from 4th July 1922 to 13th July 1922 be taken as the basis for classification, it works out that the first three groups produced between 24 and 24·7 lbs. and the last group only 20 lbs. which indicated that the last group is the only one to which a factor of correction may be necessary.

The rations selected for trial were the following:—

Check rations.	Consisting of groundnut cake, wheat bran and dhal husk.
Ration 1.	Consisting of cake and rice bran.
Ration 2.	Consisting of cake and dhal husk.
Ration 3.	Consisting of cake and wheat bran.

The quantity of concentrated rations was so arranged that along with roughage each animal weighing about 800 lbs. was supplied daily with 1·25 lbs. protein, 10 lbs. carbo-hydrates and 1·7 lbs. fat.

The regular experiments commenced on 14th July 1922 and closed on 5th October 1922. To have a standard for comparison and also to work out the necessary factors for correction, one group of cows was fed on check rations alone from beginning to end, and the other groups had a change of rations every four weeks as follows:—

Group	1st Period	2nd Period	3rd Period
A	Ration 1	Ration 2	Ration 3
B	Do 2	Do 3	Do 1
C	Do 3	Do 1	Do 2

This system enables us to find out the effect, on the same group of animals, of change of rations at the end of every four weeks. After the regular experiments were over, all the animals were again put on check rations for three weeks to bring them back to what they were started with.

The milk from each cow was weighed morning and evening and samples collected for estimation of butter-fat. Except on the day before and after change of rations when daily samples were tested, only composite samples preserved with formalin for 7 days, were analysed to study the variation in composition in morning and evening milk for each cow. In addition, all the animals were weighed on three consecutive days during the last three days of each period of rations.

The weight of milk yielded in lbs. by each group of animals as also the weight of butter-fat in it for each period of 28 days is given below.

	Yield in lbs. 1st Period		2nd Period		3rd Period	
	Milk	Butter-fat	Milk	Butter-fat	Milk	Butter-fat
Check group ..	1,274	73·1	1,107	67·7	934	55·8
Group A ..	1,420	69·4	1,298	69·8	1,165	64·0
Group B ..	1,222	66·3	858	48·3	611	34.3
Group C ..	1,154	59·5	1,039	52·7	888	46·5

The morning milk yield was uniformly higher than the evening one, but the evening milk was richer in butter-fat than the morning milk. On the whole, the butter-fat content varied from 3 per cent to as much as 10 per cent nearly. Individual cows showed sometimes 50 per cent more butterfat in evening milk than in morning milk.

The amount of work connected with these experiments has been enormous. In addition to hundreds of weighings of rations, milk, and the animals themselves, 1,344 butter-fat determinations have been made.

The Live Stock Expert and myself have not yet found time to sit together and work out some constants for each animal from records of previous lactation periods. We expect to do so in the near future and publish the results in the Journal of the Mysore Agricultural and Experimental Union.

Information on the other items of work undertaken in co-operation with the Live Stock Section, such as in daily variation weights of animals, crop cutting tests for silage making, composition of silage, etc., will be found in the report of that Section.

Spike Disease of Sandal.

Investigations on the mode of spread of disease.—Till recently, the only experimental method of transmitting the disease has been by means of grafting. Obviously this cannot be the method by which disease is transmitted in nature. Infection might proceed either through the roots or through portions of the tree above ground. The probability of root transmission seemed great from the fact that sandal root forms haustorial connections readily with other sandal roots. But clear evidence of this method of transmission was only adduced during the current year. Sandal

seedlings had been planted by twos and threes in three common pits in 1916, allowed to grow for 5 years so as to allow for good root development and haustorial connections with each other, and one of the plants in each pit was grafted with spike during July 1921. The disease appeared in the grafted trees two months later and continued to develop till July 1922 when one of the healthy trees showed signs of disease, together with phyllodi in the lower branches. Curiously enough, within a month after this, the whole tree burst out with spike which is contrary to what happens in the grafted tree where the disease proceeds downwards slowly. About this time the disease appeared on the healthy trees in the other two pits also. A month later the roots of the tree in the first pit were laid bare by carefully washing with a jet of water and three haustorial connections were found between the roots of the graft and those of the diseased trees. A detailed report about this has already been published by Dr. Coleman in the "Indian Forester".

Determination of rate of carbon assimilation in diseased and healthy sandal leaves.

The presence of a large amount of starch in spiked leaf as compared with healthy might be due either to a rapid formation of starch in the diseased leaf or to defective translocation of the starch formed in the leaf due to a decreased diastatic activity or to the action of both the factors. That it may be partly due to defective translocation was indicated by a determination of diastatic activity which was found to be only half as great in spiked leaf as in healthy.

To find directly the rate of formation of starch in the two kinds of leaves, an elaborate series of experiments was carried out in which estimations were made of carbondioxide absorbed by the two kinds of leaves per 100 sq. cm. per hour when the leaves were kept exposed to light under similar conditions, the amount of carbondioxide absorbed being taken as a measure of starch formed. The results obtained so far show that the absorption per unit area in the spiked leaf is always slightly less than that in the healthy, but unfortunately the difference is not sufficiently great as to warrant definite conclusions being drawn, for in one experiment when healthy leaves alone were taken for comparative determinations, the difference in the amount absorbed per unit area of 100 sq. cm. per hour was almost as great as the difference between that of the spiked and the healthy leaves. However, that in all the experiments in which spiked and healthy material was used, the spiked leaf has always indicated a smaller assimilation of carbondioxide, would indicate the probability that the accumulation of starch in the diseased leaf is not due to a rapid formation of starch but to defective translocation. Further experiments should be conducted in this line before definite conclusions can be drawn. In the light of recent investigations carried out in Germany by Willstatter and his collaborators on carbon assimilation where they have shown that the amount of chlorophyl and the dry matter in the leaf must also be taken into consideration in calculating the amount of carbon assimilation, attention will be bestowed upon the determination of these factors also in future experiments.

Injection Experiments.—With regard to experiments carried out last year on injecting chemicals into diseased trees to find out the behaviour of trees towards the chemicals, it was found that all the trees were dead excepting one into which potassium chloride was injected. There are still apparently healthy leaves on it though it is nearly two years since the tree got the disease. Whether this is due to the chemical injected or due to some peculiarity in the individual tree has to be found out by carrying out the same injection on other diseased trees. As there are no diseased trees fit for injection in the Laboratory compound or in Uttarahalli area where the trees are either all dead or about to die, some other suitable area will have to be chosen.

Analysis of diseased and healthy sandal leaves for the determination of its organic constituencies.

A large amount of diseased and healthy material amounting to about 10 lbs. of each has been prepared and got ready for extraction with alcohol which will be commenced soon. This line of investigation is expected to bring out the differences, if any, in the constituents of diseased and healthy material which might throw some light on the nature of the disease itself.

Analysis of oil obtained from diseased and healthy sandal wood.—Analyses of these oils have been taken up with a view to find out differences, if any, and whether it will throw any light on the nature of the disease. For this purpose, half

a ton each of the two kinds of wood have been supplied by the Forest Department. As the Forest Department wants certain additional information in connection with this work, the sandal trees have been obtained with bark and white wood and the wood has been prepared in the laboratory itself by professional men. The wood is sorted out into five main classes as usual and the sound billets are being powdered in the laboratory itself. The oil is being distilled on a small scale in the Laboratory, and on a large scale in the Government Soap Factory under the supervision of the Industrial Chemist. The other classes of wood will be powdered in the Government Sandal Oil Factory and the material sent over to the Government Soap Factory for distillation, as the small amounts of different classes of wood cannot be distilled separately in the Sandal Oil Factory itself. Analyses of the oil carried out so far have indicated that there is no striking difference between the oil from the healthy trees and that from spiked ones, both the oils satisfying the requirements of the British Pharmacopœia.

Soil Studies.—Seventy-five samples of soils from the experimental plots of the dry area of the Hebbal Farm taken out in 1915 are being analysed to find out if there is any relation between their composition, chemical as well as mechanical, and their response to manurial and cultural treatments as judged from crop yields. The same kind of work is being done with samples of soils used for pot experiments also since 1920. On the basis of such data collected on all the Experimental Farms, it is hoped to be able to give some useful and practical advice to people who send in samples of soil for analysis.

Analytical Work.—Most of the work done in the laboratory has been in connection with the above described and discussed investigations in progress. In addition, the work of testing the samples of juice from different varieties of sugar-cane under trial on the various farms has been attended to and a few samples of manures, fodders, feeding stuffs, water, etc., have been analysed for the other sections of the Department as well as other Government Departments.

The following is a statement of the analytical work done in the Laboratory and in camp in connection with the various items of work discussed till now :—

Nature of sample	No. examined	No. of determinations
I. Agricultural:—		
Crops from pot and cylinder experiments	948	2,500
Soils	50	572
Manures	49	150
Fodders and feeding stuffs	104	650
Sugar-cane juice and jaggory	290	718
Milk	1,200	1,344
Weighings of animals, etc., in feeding experiments ..	..	3,400
Spike investigation	..	350
Miscellaneous	23	50
Total ..	2,664	9,734
II. Geological:—		
Assay for gold and silver	2	6
Rocks	4	77
Limestone and Burnt lime	56	199
Kaolin	1	27
Lead	1	6
Alleged gold dust	1	12
Manganese ores	4	19
Chrome ores	4	4
Asbestos	1	20
Iron ores	99	758
Total ..	173	1,128

In conclusion, I desire to acknowledge [illegible] as been by means of g[illegible] ty co-operation of all those associated with me in work and the ungrudging and cheerful manner in which they have often put in extra hours of work.

B. NARASIMHA IYENGAR,
Agricultural Chemist.

Report of Work done in the Mycological Section during 1922-23.

Areca Kole Roga.—The losses sustained by the garden owners owing to the out[illegible]k of Kole Roga were heavy in those areas where spraying was not attended to. Though many of the garden owners were ready to take up the work they were very handicapped not only by the continuous rain during the latter part of the monsoon, but by the lack of sprayers which did not arrive in time from Germany. The disease appears to be spreading towards new areas in the direction of Kigga and Balasa in the Kadur District where the disease has never made its appearance in spite of the heavy rain fall.

The area sprayed during the year amounted to nearly 1,200 acres as against 750 acres sprayed during the previous year, thus showing an increase of 450 acres more than last year. The following statement shows hobliwar the areas where spraying was done last year, in Sagar, Tirthahalli, Nagar and Koppa Taluks :—

Taluk	Acres	Taluk	Acres
Sagar Taluk.		**Tirthahalli Taluk.**	
Kasaba	8		
Talguppa	94	Kasaba	74½
Barangi	46½	Muthoor	142½
Avinahalli	59	Agumbe	172
Karoor	206		
Ananthapur	1½	Total ...	389
Total ...	415		
		Koppa Taluk.	
Nagar Taluk.			
Kasaba	48	Koppa	8
Nagar	20¼	Sringeri	6
Kerehalli	10	Hariharpur	70
Humcha	8	Megund	2
Lakshmipur	176		
Total ...	262¼	Total ...	86

Total area sprayed 1,152 acres.

Owing to the lack of good sprayers the work was considerably handicapped. The "Ubel" sprayers imported from England during the previous year were not found to be up to the mark. About 120 of these were hired out to the garden owners to facilitate their work. The popularity of the spraying work in the malnad areas can be judged by the fact that since the last monsoon season we were able to sell 380 Holder sprayers at Rs. 25 each. A further consignment of 200 sprayers is expected to arrive shortly.

The laboratory work on the use of casein as an adhesive in the spraying mixture in the place of resin and soda was extended this year, so as to give the new mixture a field trial under malnad conditions. These trials showed that ½ lb. of casein for 25 gallons of the mixture proved to be an efficient adhesive even against the heavy rain fall of the Ghat areas, while, at the same time, the cost of the mixture was reduced.

The results of the trials are appended herewith :—

Place	Number of trees	Date of spraying	Size of the nuts at the time of spraying	Average rainfall	Results
Sagar Taluk.	This line of investigation not diseased				
Marthur Farm ...	500	13-6-22	Fairly developed.	120"	2 trees found infected on 29-8-22 (½ lb. casein).
Hakkare ...	92	6-7-22	Small	100"-120"	No disease (½ lb. casein)
Talneera (Karur) ...	73	20-6-22	do	200"-250'	Do

Place	Number of trees	Date of spraying	Size of the nuts at the time of spraying	Average rainfall	Results
TIRTHAHALLI TALUK.					
Kerodi ..	45	17-6-22	Small	150"	Two trees infected (½ lb. casein).
Nagarvalli ...	35	19-6-22	Fairly developed.	About 150"	No disease (½ lb. casein)
Aragudige ...	30	20-6-22	Small	do	Ten trees infected owing to a drizzle soon after spraying (½ lb. casein).
Asemane ...	26	29-6-22	do	200"-250"	Mixture washed off soon after spraying (½ lb. casein.)
Chimitagunde (Agumbe) ...	49	13-7-22	Fairly developed.	300"-350"	Six trees infected. Resprayed (½ lb. casein).
NAGAR TALUK.					
Sampekatte ...	25	9-6-22	Small	200"-250"	No disease, (1 lb. casein).
Manjagalale ...	25	8-6-22	do	200"-250"	do
Do ...	25	12-6-22	do	do	do (½ lb. casein).
KOPPA TALUK.					
Hariharpur ...	25	3-7-22	Fairly developed.	About 150"	do (½ lb. casein).
Kavalkudige (Sringeri) ...	25	4-7-22	Small	150"	do do
Nebi (Megund) ..	50	12-8-22	Large	200"	do (½ lb. casein).

The details of the preparation of the new mixture were set forth in an article in the Agricultural Calendar for 1923.

The Agumbe garden had no disease this year also so that this was the ninth year since spraying work was discontinued in this garden.

Other plants affected by Kole Roga.—A disease similar to that of areca Kole roga was observed on sandal, causing all the leaves to drop down. The injury caused was not severe except for the death of the smaller twigs and flowers, seeing that new shoots were put forth in two or three months. Similar diseases were also observed on some of the common weeds round about the garden, such as Bryophyllum calycinum, and Colocasia antiquorum, as also on some of the wild fig trees. The point of interest with regard to these is whether these diseases on the sandal and on the wild plants can be transmitted on to areca. Cross inoculation experiments are being tried in the laboratory. This question has direct bearing on the problem of stamping out the Kole roga of areca.

The spraying work that is being carried on in the malnad has attracted the attention of the garden owners of South Canara. With the concurrence of the Madras Agricultural Department these were supplied with materials for spraying worth about Rs. 1,000.

The Root Disease of areca nut.—The fungus causing this disease (Thielaviopsis) was brought into pure culture and inoculated into healthy areca trees. The results of these experiments are awaited.

During the present year it was noticed that the areca nuts began to drop off during May in the Ghat areas of Kallurkatte and Sagar. This is supposed to be due to an insect called Bachehula. Nearly a third of the crop was lost before the outbreak of the monsoon. No work has been taken up on the subject, but it seems likely that the dropping of the nuts is due to adverse physiological conditions rather than to any insect attack.

Coffee Diseases.—In connection with Coffee Black Rot the hibernating stage of the disease was found. A number of wild plants were also found attacked by a disease similar to that of Coffee Black Rot. It is not known as yet if the diseases are one and the same. A bulletin on the Black Rot of Coffee has been issued during the year.

The Die-Back of coffee was very severe during the year especially in estates near Sollebail and Balehonnur. The continuous rainfall proved very favourable for the spread of the disease. Application of lime as tried by some of the planters had no effect in checking the disease. It is proposed to take up experiments this year in checking the disease.

Ragi-smut.—Ragi seeds from infected areas near Dodballapur were treated with different strengths of copper sulphate, copper sulphate and lime, and formalin for different periods and were sown in pots. In some of the pots ragi seeds mixed with smut spores were sown. About a dozen plants were grown in each pot. The experiment was started on 26th December 1922 and by March all the plants formed ear-heads. No smut could be found in either the treated or the untreated series. It is proposed to start the experiment again during July this year.

Betel Vine Mildew.—As reported during the last Conference the spraying against the betel vine mildew in Kolar was continued. The last spraying was done during August 1922 and the vines were reported to have had no severe attack. As soon as a report about the outbreak of the disease is received this year, work will be taken up again for the present year.

Grape Vine Mildew.—On the tender fruits this was found to occur in a garden near Lalbagh, Bangalore. In addition the leaves were affected by rust (Uredo Vialeæ). The vines were sprayed during December with Bordeaux (5.5.50) with ½ lb. of Casein as an adhesive. Subsequent inspections of the garden showed that the spraying was very effective. The fruits were free from disease and at the same time the rust was almost absent on the leaves.

Thielaviopsis on Plantains.—Inoculation of the fungus into pseudostems of the plantains resulted in the development of the symptoms, characteristic of the disease on the field. The fruits were withered and quite undeveloped and the base of the stem showed local discoloration.

Sandal Spike Work.—Hitherto the sandal plants in the laboratory compound have been found to develop symptoms of spike only when they were grafted with a piece of the spiked twig.

During the present year some of the trees adjoining the grafted spiked trees began to develop the symptoms although no grafts were made on them. About six trees were found to get spiked in this manner. It was thought that they might have developed the symptoms owing to the formation of root connections between the healthy and spiked trees. Elaborate arrangements were made to wash out the soil round the roots so as to get at the root connections without injuring them. Root connections about three in number were obtained with the greatest difficulty and photographs taken. An article on this subject is found in the Indian Forester. There can be no doubt that root connections are one of the sources of the spread of the disease.

I examined a large number of specimens of spike received from Dharmapuri Range, Salem District, and from Chatrapur, Ganjam District.

Spike disease was reported also from near Closepet. A survey of the area was made and a report submitted. In the Hallimala area I found spiked sandal very often associated with spiked zizyphus. Arrangements were made to trace the root fonnections between the two but since the diseased sandal was in a very advanced stage haustoria could not be obtained, though unmistakable scars of the haustoria of the zizyphus roots were noticed.

A large number of the diseased specimens of various crops were examined. The school work was attended to by Mr. S. V. Venkatarayan in addition to his work in the laboratory.

M. J. NARASIMHAN,
Senior Assistant Mycologist.

Report of work done in the Entomological Section, during the year ending 30th June 1923.

Kamblihula (Amsacta albistriga).—The campaign against this pest was conducted as usual in the following villages in the Shimoga, Chitaldrug and Kolar Districts.

Taluks	Villages	Number of moths caught	Caterpillars
Honnali	Masadi	23,686	70,000
	Bidergadde	..	12,555
	Gollarhalli	2,271	88,422
	Balemallur	6,469	5448,000
	Didagur	6,797	10,610
Davangere	Hadadi	9,990	14,904
	Guthoor	9,107	8,538
	Kaidaley	27,702	51,300
	Mudhadadi	10,981	5,426
	Kodaganur	2,023	1,914
Holalkere	Sasalu		
	Kalghatta		
	Dindiganhalli	83,603	13,200
	Hiriyur		
	Gyranahalli		
	Viswanathanhalli		
Channagiri	Siddanmatt		
	Yekkegundi	58,583	22,400
	Dodderkatte		
Kolar	Kolar	27,887	32,712
	Sankondanhalli	..	79,964
	Kodikannur	1,200	92,947
	Total ...	270,299	557,594

A total of 270,299 moths representing about 135 million caterpillars have been destroyed.

In Kolar District the pest appears to have been on the increase. In parts of this district, land is ploughed in March and April and sufficient rains are received. Advantage was taken of this to test the possibility of controlling the pest by early ploughing. It was found, however, that many pupae survived the operation and no less than 947 moths emerged from the ploughed area of 7 acres, which is sufficiently large for a heavy infestation. We have thus to fall back on hand picking in this district as well. The life-history of the pest was explained to the raiyats in many of the localities and pamphlets printed at the expense of the District Board and illustrative charts were distributed last year. An officer was sent again early this year for preparing the people further for a campaign against the pest during the coming season. Rupees 802 have been collected or promised towards the payment of moths when collected. There can be no doubt that the raiyats are interested in the combative measure recommended by this department. Whether the interest will prove equal to the strain of finding sufficient labour for the work at the time remains to be seen. No risks are being taken and proposals before the Government for declaring the three hoblies under the Pest Act have been recently sanctioned.

The area taken up for work in this district is comparatively large and limitations of staff do not permit of the continuance any longer of departmental supervision in the villages in the Shimoga and Chitaldrug Districts, nor does it appear advisable. The raiyats in the infested villages have now been familiar for ten years with the methods of control and if they neglect to carry them out it will be their fault nor is neglect likely to continue long. The resulting loss of crop is too serious for the raiyats to remain indifferent.

It is proposed this year to carry out certain observations and experiments to simplify the operation of picking. It has not been determined whether daily picking is absolutely necessary and whether matters can be so arranged that the entire area need not be covered daily in search of moths. Efforts will be made to obtain exact information on these points.

Mango-hoppers (*Idiocerus spp.*)—Observations and experiments with a view to find a simpler remedy than spraying have been continued but without success. In some gardens the trees blossomed a little in advance of the reproduction of the hoppers. When the interval was sufficiently long the crop escaped to a great extent; when it was too short it suffered. This shows temperature is a factor in the incidence and virulence of the pest. The difference in the susceptibility of the three species to high temperature has again been tested and confirmed. The possibility, therefore, occurred that the insects may seek the shade of shelters provided during the hot season. A variety of shelters were tried but they did not prove attractive. The shelters were more readily sought during rains but even then the numbers that were satisfied with the underside of leaves were too many. A second series of experiments suggested by the observation that hoppers fed on half mature leaves of the mangoes when blossoms are no longer available has yet led to no result.

With regard to the carrying over of the pest from year to year it appears probable that the irregularity of blossoming in individual gardens is a factor that cannot be neglected. The hoppers multiply in the buds and weather permitting, on the tender leaves but mainly on the buds and blossoms. If therefore there is a definite alternation in regard to blossoms, that is to say, if all the trees in a garden blossom in one year and fail to do so the next, the hoppers produced in one year will have to wait nearly two years for multiplying again except for the chance of reproduction in July or October. There are likely to be few survivals from such a prolonged period of rest, and the pest would not be formidable. As a matter of fact, however, the trees in no garden behave similarly in this fashion. In the same year and in the same garden, there may be found trees which blossom and those which do not. There is thus always a chance for the hoppers to reproduce every year to howsoever limited an extent. This helps to carry over the insect from year to year. In years, however, when the blossoming is very poor, opportunities for multiplication are very limited and but few individuals are left to start the pest when blossoming is heavy again the year following. And if that year the blossoming is well in advance of the breeding season of hoppers or takes place in weather too warm for continued multiplication of the hoppers, the crop may escape without much harm. If therefore, we are prepared to sacrifice the small crop of alternate years, we may destroy the blossoms and young leaves that appear in these years.

The sacrifice of the crop suggested may not be necessary every alternate year. There is some reason for thinking that a definite alternation does not always take place. The blossoms may fail only once in three years. In that case the sequence may be somewhat as follows:—

Fair or heavy blossoming	Pest bad.
Heavy or fair blossoming	Pest very bad.
Few blossoming	Pest little.
Heavy blossoms	Pest little or moderate.
Fair blossoming	Bad or very bad.

In this case there are two years in succession when the pest has a chance to multiply. There are therefore a very large number of survivals to start the pest in the second year when, as a result, the pest may be extremely serious. Even in this case the careful destruction of the pest during the off-year may help in no small measure to prevent serious loss in the two successive years.

I have described this hypothesis in more detail, because, if it is found correct we may be able to devise a simpler method than spraying. The sacrifice of the crop every alternate or every third year may prevent the hoppers being carried over and so save succeeding crops. Observations and experiments have been planned along these lines, and it will take some time before reliable results are obtained. In the meanwhile the distance of flight of the hoppers and kindred phenomena with important bearings on the question have to be determined.

Rhinoceros Beetle (*Orycetes rhinoceros*).—The experiment of treating the floor of the pits with lead arsenate has been carried out on a more extended scale. Some observations point to the conclusion that larvae do not necessarily eat through the soil on their way to pupation. This has a very important bearing on this line of treatment and poisoning must be to the manure itself a few inches above the floor level.

It was pointed out last year that there are other serious obstacles in the way of the adoption of this remedy, mainly arising from the different methods of storing the manure and efforts were directed to find other lines of attack. Observations made show that the shape of the pit determines in which situations in the pit the manure becomes dry and there are indications that larvae prefer these situations to others where manure is more moist and compact. To determine the point manure has been stored in pits of different shapes. These, when they are examined, as they will be shortly, will give us a better idea of the shape that manure pits should have.

If, as I hope by these means, larvae can be induced to concentrate in one place in the pits, it should not be difficult to devise some methods of trapping them there. The pursuit of this idea has led to the enunciation of an important generalisation in Economic Entomology which has been published in the March issue of the Bulletin of Entomological Research, London. The principle is this that where, in a pest, the body of the larva is soft and of the adult hard and rigid, the difference may be utilised in effecting methods of control. It is hoped this principle would be of help in controlling the rhinoceros beetle. If as I believe the manure pit can be so constructed that all larvae have to enter the soil for pupation, by the interposition of a screen of a definite mesh at the place of the entry into the soil the insect could be prevented from effecting successfully its retnrn journey as the adult beetle. I have planned a few devises based on this principle by which I hope to be able to trap the beetle in the manure pit.

The treatment of the pest found in decayed tree logs and stumps would remain. Beyond the destruction of the pest by burning, we are helpless, unless some methods are found of attracting the beetle to chemicals or baits. The problem of the pest is an exceedingly complex one for which no satisfactory solution has been found in any of the tropical countries where it has been under investigation for several decades.

The principle enunciated in this connection, the second to the credit of the section, represents a definite step towards a solution. It opens out a new line of attack against other pests as well. We have found that flies whose maggots can pass through a perforated zinc sheet cannot as adults repass through the same sheet. It is possible then to construct a trap in which the maggots that result from oviposition on the bait provided are induced to pass through to a chamber for pupation from which escape of the adult is impossible. The principle may also be extended by including in it cases where the borer of both the larvae and the adult are rigid but so different in shape that holes through which one can pass are impassable for the other.

Insecticidal Property of Metallic Mercury.—This property of metallic mercury was established scientifically for the first time some years ago. Some doubt was cast on it at the Conference at Pusa where a paper was read in 1919. The question was taken up at my suggestion by the U. S. Bureau of Entomology, and I am glad to say my results have been confirmed by results obtained there. One other use to which mercury appears to have been put in India is against pickle flies (Drosophila sp.) I have conducted experiments which prove the correctness of this belief as well. Infested pickle was equally divided between two jars and in one a small quantity of mercury was suspended in a cloth bag. In the course of a couple of weeks there were no flies in the jar with mercury while the other swarmed with them. Some observations however, point to the fact that the effectiveness of the metal is dependant on certain conditions. What these conditions are have yet to be determined. The period of exposure to mercury vapour required to kill Bruchid eggs has been found to be as short as one hour. From the experiments, it would appear that the vapour ceases to have effect from the time the larva has definitely formed within the egg shell. This result has to be confirmed. A third experiment is in progress to test the influence of the vapour on the pupal stage.

One other line of experiment with mercury was with white ants. It was hoped that vapour from the metal would be given off more quickly in the nest under ground under the higher temperature that prevails there and that it would gradually act on the eggs. A small quantity of mercury was let down into the nests in small pots and allowed to remain for about two months. On opening one of the nests recently, the pot was found completely plugged with earth to the brim, so hard that to recover the mercury the pot had to be broken. The remaining pits have yet to be examined.

Fish poisons as insecticides.—One other plant has been added to the collection but little work has been done to test their value as insecticides. Some of the experiments carried out have given negative results. More work will be done as opportunity occurs.

The Coffee Borer.—It was pointed out last year that the serious disparity in results obtained with the treatment of coffee trees with Brunolinum was possibly due to difference in composition. That conclusion has been justified; for complaints of a similar character have been heard since, from other countries. Efforts have been made to obtain material of a guaranteed standard, but it looks as though such a guarantee is difficult to obtain and usually not worth having in regard to a product which is a crude distilate of variable composition. I have therefore decided to concentrate more attention to the adult beetles. Various experiments and observations have been made but so far no clue to its whereabouts on the estates has been obtained. It is proposed, however, to start the systematic collection of the beetles during the next season in at least two estates and observe the effect next year on the degree of infestation. Further observations and experiments will be made to trap the beetles.

The Castor Semilooper.—Demonstrations of the best methods now known of the control of the pest were made in 27 villages in the taluks of Channapatna, Closepet, Kankanhalli, Tumkur and Gubbi. Various traps were tried to catch the moths. In all these, provision was made for entry but not for exit. None of these proved successful. Baits were also tried of various fruits but with little success. A new line of work has been suggested by results obtained in the United States. This will be tried next season as also traps improved in the light of past year's experience.

The Sugar-cane Borer.—The simple method announced last year of controlling this pest has been tested again on the Babboor Farm with equally good results. About a thousand moths were caught from nearly 20 acres and the percentage of infestation was only 1·5-2. It should be remembered, however, that in the previous year damage to the cane on the farm had been reduced to 2-5 per cent and examination of this crop at the time of harvest showed only an infestation of 6 per cent. Against this however, has to be set the fact that elephant grass in the marshy lands was badly infested with Sesamia and the cold weather crop of jola was equally badly infested. The trash heaps attract not only sugar-cane borer moths but others representing a large variety of species most of them of no economical importance but some of them pests. These species have not yet been identified. Another interesting feature is that besides moths, cockroaches, crickets and beetles also seek shelter in these in large numbers. Over 60 were counted of crickets alone in one heap and crickets are in part responsible for dead hearts gnawing a hole into the seedling from outside at the point of growth. Among the beetles one species is a predator which has been found to feed on the borer moths.

There are indications that the principle employed in this remedy is capable of application to other moth pests and it is proposed to test the trash method against the paddy stem borer moth, Spodoptera and others when opportunity occurs.

The cost of the remedy may be even less than the figure given last year. The number of trash heaps was only nine per acre and not more than two boys were required to go over 20 acres. This makes up the cost at even less than Rs. 2 per acre.

The conditions under which the remedy was tested were specially exacting. In several of the fields sunnhemp had been cut and placed on the ridges; some were not weeded or had the weeds pulled out but not removed from the field. This opportunity was not missed to find out the preference of the moths. These shelters of grass and other weeds are not usually sought when heaps of dry leaves are available. Sesamia may hide in weeds removed and left to dry and heaps of jola stalks, and elephant grass have been found to harbour moths. The experiments have to be carried out further but results are of interest in view of the difficulty that has been raised by some that trash from the diseased canes may communicate disease to the young canes amidst which it is placed. Even if this were the case which I do not believe, so far as Mysore is concerned, it would not be difficult to obtain trash from disease free canes or to subject trash from diseased cane fields to

treatment before being used as traps, and if the results of the experiment referred to above establish the fact that moths have no decided preferences in regard to dry leaves, the question does not arise at all.

Another experiment was tried to find whether one large trap could replace a number of smaller ones. So far the replacement has not proved satisfactory but it is proposed to repeat it to determine the point.

It was stated last year that traps would be designed which while letting the moths in would not let them out. Several traps were tested but none of them found quite satisfactory. Cane trash is not a suitable material for making traps which are smooth and even outside. Crevices, cracks and folds appear to be unavoidable and in these moths hide without getting in. Suggestions by the experiences of others have been made and will be tested soon.

Both the Junior Assistants have demonstrated the remedy in as many localities as possible. Enquiries have been received from several parts of India and advice has been given. The remedy is being applied now on the Seedling Farm at Coimbatore where, however, the conditions are specially exacting.

Interesting points in the life history of the pest have been studied and rearings of the various species have been carried out again. The search for the alternate host-plants has been renewed and several parasites have been collected.

Tobacco Aphis.—As a result of the excellent results obtained by spraying against the pest, there have been several requests for assistance which have been complied with.

Cotton-Boll-Worm (*Earias sp.*).—Some observations and experiments were made last year on this pest. Several attempts to trap the moths failed. More work will be done next year.

Lime Tree Borer.—The life history work is progressing satisfactorily. The adult beetle emerges late in the hot season but does not get out of the tree immediately. It remains in the pupal chamber where it is well screened before and behind by partition walls made of borings compacted together and reinforced by a layer of calcium carbonate and does not leave it until the first showers of the monsoons have been received. The beetle has a very sweet smell recalling that of lemon grass oil, which is perhaps an additional protection.

Reports of Pests.—Among serious pests reported are two, a caterpillar pest on cardamoms which seems to have been very severe in some parts of Saklespur and Mudgere Taluks. The places were visited late but a few pupæ have been collected and it is hoped that we may be able to determine the identity of the pest. Another pest has been reported to be serious, destroying young shoots of ficus tress in Turuvekere Range. The moth is Hypsa ficus. The localities will be inspected soon and control measures tried.

Requests for assistance and help have increased in number and as far as possible they have been complied with.

Entomological Conference at Pusa.—I represented the section at the Conference. Two papers were read by me—one on the Function of the prothoracie Plate in Mylabrid Larvae, the other on the Sugar-cane Borer. Two resolutions were also moved of which one was on the introduction of Entomology as a separate subject for Arts degree. A lecture on "Entomology in the United States" was also delivered.

Publications.—Bulletin on the function of the prothoracie Plate in the Mylabrid larvae.

Lecture on the conditions of Entomological work in India. (Proc. Howaii. Ent. Society).
A Useful Plant for India (Agricultural Journal India).
A New Principle in Economic Entomology (Bulletin Entomological Research, London).

Staff.—I repeat with additional emphasis what I have said in my last report in regard to the staff and equipment. The want of sufficient facilities in these respects has been seriously felt as a handicap to investigation and demonstration.

K. KUNHI KANNAN,
Senior Assistant Entomologist.

Report of work done in the Botanical Section during 1922-23.

The work in the Botanical Section was continued on the same lines as in previous years mainly on ragi, sugar-cane, and ground-nut improvement. Preliminary work on paddy selection was started on the Hebbal Farm and on the Marthur Farm. The spontaneous flowering of the potato crop in October gave us an opportunity for starting breeding work on potato. A special grant of Rs. 1,000 was kindly sanctioned by the Government to carry on this work. A new well was sunk in the dry area to bring a piece of land under irrigation for the first time. Thus any old land under irrigation having ring-disease bacteria has been avoided. The staff of the section was strengthened by the addition of one senior Agricultural Inspector during the latter part of the year. Work on the testing of fodder crops was started in co-operation with the Live Stock Expert. An extensive tour was made in the south-western part of the State to make *kar* ragi plant selection in the fields. The selected plants are now being tested on the Hebbal Farm for want of a suitable place under our control in the *kar* ragi area. The present staff was just sufficient to carry on the work some five years ago, but at present the work has expanded far beyond the capacity of the staff and requires immediate strengthening. An assistant to take up class work in the Agricultural School is urgently wanted. The need for a separate clerk for the section has become quite urgent. I was on tour for 53 days during the year to inspect crops on the farms and to make plant selections.

Season.—The cultivation season began with a very disappointing out-look, but during the latter part of the year very heavy rains fell and relieved the situation. In October 16·31 inches of rain fell breaking all previous records for that month. On most of the days in October the rains were very heavy and were not of much use to the dry-land crops. The total rainfall for the year was 43·18″ but during the cultivation season it was 34·25″ distributed over 69 days of which on 38 days rain fell in such slight drizzles that they were not of much use.

Rain-fall.

Year	Total for the year	For the season	Total rainy days in the season
1921	36·4″	27·60″	71
1922	43·18″	34·29″	69

Rainfall during the season in 1922.

Month	Total for each month	No. of days with below 25 cents	50 cents	Above 50 cents	Total No. of rainy days
July ..	3·02″	13	2	1	16
August ..	4·02″	12	..	3	15
September ..	3·43″	6	2	3	11
October ..	16·31″	4	2	9	15
November ..	7·51″	3	3	6	12
Total ..	34·29″	38	9	22	69

Hain Ragi.—Nearly 300 types of ragies were tested in the varietal plots. The best of them representing the standard varieties of the State, were grouped together for permanent test plots in 1921. Out of the large number of 42 pedigree seeds, some were not satisfactory. A grouping of the best was made in the previous year and the low yielders were all given one more chance before final rejection. A large number of plant selections made in the districts and grown in lines in 1921 were all tested and it was found that many of them were promising. Some of the new strains of ragies sent out to the Union members for preliminary trials have met with great success. Observation regarding the pollination of ragi flower and attempts to discover methods for hybridisation were continued in the laboratory

during the season and a number of photographs were taken to illustrate the different processes employed. None of the ragi fields was drilled with cake powder during the season.

Varietal Tests.—Fourteen types were tested. Only one type has given better results than the local ragi. Generally during heavy rainy seasons the heavy headed and late types give good yields. The best of them were the following :—

Variety.	Per acre		Per cent yield	
	Grain	Straw	Grain	Straw
	lbs.	lbs.	lbs.	lbs.
C. 10-Local Hullubele	735	934	100·0	100·0
C. 10-Genumudda	752	1,047	96·1	115·4
C. 8-Gudubele	855	1,264	114·5	138·9
C. 7-Karigidd	756	1,281	100·8	128·7
C. 1-Madayyanageri	518	1,011	73·2	109·8

Pedigree seeds.—In field 6, fourteen of the most promising ones were tested during the season. Many of them are far superior to the local Hullubele and even H. 22. During the present year H. 22 has given slightly lower yield than the local Hullubele. The best of these have been already given over to the farm for increasing the seeds for distribution purposes. The best of them with their results for 2 years are given below :—

F. 6 Variety	1921		1922	
	Grain per acre	Yield	Grain per acre	Yield
	lbs.	Per cent	lbs.	Per cent
Local Hullubele	790	100·0	1,170	100·0
H. 2	1,035	110·5	1,528	133·3
H. 40	983	115·9	1,553	128·4
H. 50	1,282	120·7	1,315	123·4
H. 13	852	105·2	1,404	116·1
H. 39	876	109·5	1,378	114·4
H. 22	907	102·1	1,095	98·8

In the previous years, all of them were better than the local Hullubele, but during this season 12 have given better results in grain and 13 in straw.

In field 8, a further section of 14 pedigree seeds were tested. Eleven of them have given better results than the local Hullubele and all of them have given more straw. The best of them with their yields for two years are given below :—

Field 8, Variety	1921		1922	
	Grain per acre	Per cent Yield	Grain per acre	Per cent Yield
	lbs.	lbs.	lbs.	lbs.
Local Hullubele	1,110	100·0	946	100·0
H 47	1,257	111·6	1,139	120·0
H 94	652	119·9	1,115	118·9
H 77	634	108·7	1,036	118·0
H 92	688	122·1	1,102	115·1
H 71	1,235	113·5	1,118	114·6
H 82	778	122·0	1,081	111·8

In field 10, out of fourteen pedigree seeds tested, four have given better results in grain and nine in straw. Yields of the best ones for two years are given below:—

Variety	1921		1922	
	Grain per acre	Per cent Yield	Grain per acre	Per cent Yield
	lbs.	lbs.	lbs.	lbs.
Local Hullubele	1,079	100·00	494	100·00
H ·45	1,101	108·4	724	109·3
H ·55	1,225	108·9	682	109·7
H ·64	1,206	109.4	572	102·9
H·60	1,146	105·1	780	110·9

New plant selection.—A large collection of selected plants was made in the fields, in selected areas of the State. They were all grown in single lines in 1921 and the best of them were picked out for further trials on the test plots. Out of 19, only nine have given better results than the local Hullubele. Many of them seem to be good drought resisters. After another year's test the low yielders will be rejected and in the space made available seeds of fresh plant selections will be substituted. The best of them were the following:—

Variety	Per cent yield Grain
Local Hullubele	100·0
C ·362	121·9
C ·401	113·1
C ·412	153·8
C ·417	110·0
C ·530	114·3
C · 75	118·0

Line Tests.—Out of 18 types tested in the preliminary test plots, the following 15 have given promising results:—

Variety	Per cent yield Grain
Local Hullubele	100·0
C ·579	120·4
C ·528	118·4
C ·533	134·8
C ·534	126·3
C ·537	120·9
C ·537	120·2
C ·538	110·7

District Collections.—The collections of seeds were all grown as usual and their behaviour regarding yield of grain and straw was noted. As there is no space available, a large number of types will be rejected to make place for others if they happen to resemble some of the standard types.

Irrigated Ragies.—There is no typical place on the Hebbal Farm to test irrigated ragies. Different situations were selected to represent various conditions where irrigated ragies are generally grown. The growth was very stunted and unhealthy in water-logged situations and the yields were low, whereas on plots having good drainage the growth was remarkable. In some places H. 41 had grown to a height of 5 ft., but of the two types selected from Kolar District, Kolar No. 1 seems to be the better one. It is an early ripener and possesses compact green earheads. The Hebbal ragies on the other hand ripen a fortnight later and produce very heavy yields. If the usual rotation is not upset by the lateness of these varieties, it is worthwhile to distribute them to the garden ragi growers.

In all the trials the varieties were grown in nurseries and transplanted in rows 6" apart. They were grown in duplicate plots to get average yields.

Variety	Water-logged stiff soils	Badly-drained stiff soils	Well drained open loamy soil
	lbs.	lbs.	lbs.
Kolar 1	180·7	483·0	2240·0
H ·41	220·0	725·0	3360·0

Ragi Experiments at Sabbanahalli.—Round about Sabbanahalli H. 22 has become fairly common and has to a very great extent displaced the local ragi. The season for 1922 was very droughty and in most of the villages the crops were disappointing. Though the yields given below are low they show out the superiority of the new strains especially so under droughty conditions.

Area of each plot 1-29·6 acres was repeated three times. Sown on 21st June 1922, harvested on 18th November 1922 and threshed on 9th January 1923.

Variety	Yield per acre.	
	In seers.	In lbs.
Local Kurubasidda	263·73	560·42
Jadesankara	271·13	576·15
H ·22	365·08	775·79
H ·39	389·63	828·75
H ·40	505·56	1074·31
H ·43	505·56	1074·31
H ·44	461·16	879·84

The seeds of these have been distributed to several other places but so far reports have not yet been received. Favourable opinion has been expressed in several quarters. The demand is for certain early ripeners in several localities since H. 22 is said to ripen late in the season. Some early ripeners will be tested in such places during the present season. In the *hain* ragi area H. 22 has becme very popular. Extensive areas of it are now being grown and in many santhes H. 22 ragi was sold for seed purposes only. There are now slightly over 20,000 acres of it in the State.

Kar Ragi.—As the demand for *kar* ragi is increasing yearly it was decided to start selection work immediately. A tour was made in the *kar* ragi area and nearly a hundred individual plants have been selected. As no place was available for carrying on the experiment in the *kar* area, the seeds have been sown on the Hebbal Farm to save the selections and multiply them if possible. An area of about 25 acres at least is necessary in a central place like Hunsur to continue this work.

Fertilisation of ragi flower.—Further work on ragi flower pollination was conducted. Attempts were made in the fields to imitate laboratory conditions to induce the pollen-sacs to come out of the glumes without bursting. Wide test tubes or small flasks lined with moist filter paper were inverted over trimmed flower; heads and the mouths plugged with absorbent cotton. The flask was kept in position by tying it to a stake driven into the ground near the plant. In this method the pollen sacs did come out intact but when the test tubes or flasks were removed, in a very short time the breeze and the heat of the day burst them. In case the work has to be done it must be got through quickly in the early hours of the morning before sun rise. The methods will be tested during the present season. Three hybridised seeds were obtained during the season but two of them have been unfortunately lost. Attempts will be made this season to obtain more seeds from several crosses.

Sugar-cane.—The large collection of seedlings was regrouped and planted during the season. A very large number of them were destroyed as they were not good yielders. At present there are only about 150 seedlings in the stud plots. In the space made available fresh seedlings raised from various exotic canes have been planted. All the exotics and other canes from Northern India were continued. All the bud variations noticed were isolated and planted. Work at Sabbanahalli was continued and the district work has been remarkably successful in the introduction of H. M. 544 to various cane breeding areas.

Fresh Seedlings.—In 1922 nearly 615 new seedlings were successfully raised and planted. They were all tested during the season and 56 selections have been made. As space is not available to make use of all the material, seedlings were raised only from 31 varieties and nearly 900 of them have been already planted during the present season.

Standard Tests.—These were conducted on the farm. H. M. 544 and H. M. 312 were tested against R. M., P. O. J. 33a, and local Pattapatti. The yields were not very big and the differences were not very great. But compared with the local cane the seedlings have given better results.

A. and B. Range Varietal Tests.—Yields of the three-row strips repeated three times. The canes were badly lodged and dried up when milled. H. M. 312 arrowed to some extent.

Variety	Yield per acre		Average yield per acre	
	Cake. Wt. of canes	Cake and Am. Phos. Wt. of canes	Wt. of cane in tons	Jaggory Md. of 28 lbs.
	Tons.	Tons.	Tons.	Mds.
R. M.	39·6	41·2	40·4	347·0
Local striped	22·0	21·1	21·5	200·0
H. M. 312	36·8	36·8	36·8	330·0
P. O. J. 33a	38·1	39·0	38·5	340·0
H. M. 544	45·6	43·4	44·5	418·0

B. Range.—This is the second year when the new seedlings were tested. B. Range as a whole is water-logged and not so good as A. Range. But the seedlings are giving very good yields in spite of the above drawbacks in the plots, and insufficient manuring. When the canes were milled they were lodged badly and had begun to deteriorate. Especially the early rains started new growth and shooting of the buds. The growth of H. M. 320 was remarkably uniform and good from start to finish.

Variety	Yield of cane per acre.		Average yield per acre	
	Cake	Cake and Am2 So4	Cake	Jaggory in maunds
	Tons.	Tons.	Tons.	Mds.
R. M.	34·8	43·1	38·9	331·0
H. M. 320	44·6	45·0	44·8	451·0
H. M. 332	38·2	43·0	40·6	426·3
H. M. 313	37·5	39·9	38·7	373·9
H. M. 553	35·5	39·6	37·5	326·6

In some places H. M. 544 has grown so thick that it is rather difficult to mill with the ordinary two roller-mill and small bullocks. The cane merely gets flattened and passes out with plenty of juice and necessarily the quantity of jaggory made will be below the estimate. There is a definite relation between the thickness of the cane and the amount of tillering. Thin canes and dwarf canes naturally tiller freely. But heavy tall canes give more weight. It is for this reason H. M. 544 does not produce as many canes as the local Pattapatti. The great advantage with the local Pattapatti is that all the canes formed in a clump are fairly uniform and it reaches maturity comparatively at an early period. Whereas H. M. 544 germinates slowly and the bottom portion of the cane has very sluggish buds and when the canes are over-ripe the buds do not germinate satisfactorily. These defects are overcome gradually by the availability of tops more and more, as the area under it gets extended. Anyhow as a precautionary measure even for seed distribution it would be better to cut the canes when they are eleven or twelve months old and plant only the top third or half of the cane. Further by selecting only

such of those clumps which possess many uniform canes for planting, the present defect may be greatly overcome. Reports received from various places are favourable and its popularity is increasing. The average for the whole manurial plot was about 46·5 tons of cane to the acre, a figure quite encouraging to many a cane planter. The growth in this plot has attracted many and won the approbation of even the Hebbal raiyat. It was not possible to meet the demand for seed in several cases. It has done very well at Shikarpur, one of our extensive cane tracts in the State, under abnormally droughty conditions and seems well suited for that locality. In Kolar district under good cultivation it seems to have a bright future. It has gone to so many places in the districts now and it will be difficult to keep trace of its distribution hereafter. In H. M. 320 we have found another good cane for the State. It is a medium hard cane slightly tinged with greenish brown colour. It is thinner than H. M. 544 and tillers freely. It has no scrappy growth about it, as is sometimes found in H. M. 544 on poor soils and it ripens early. It has rich juice and produces good jaggory. Already at Sabbanahalli and at Hebbal it has been competing with H. M. 544. At Hebbal it produced nearly 451 maunds jaggory per acre and in 1921 it gave 547 maunds of jaggory, to the acre. It has been distributed to other farms for preliminary trials. Other seedlings H. M. 332, H. M. 313 and H. M. 553 are fair in growth and produce large quantities of jaggory. H. M. 313 flowers early and stops growth. H. M. 332 has not a uniform growth. H. M. 553 is a white cane which does not turn red on exposure to sun. It is a rich cane and is promising. Their growth in the present season has been very satisfactory.

Three row tests of new seedlings (Range B.)—Low yielders were rejected last year and a new grouping was made. The whole plot is divided into 6 strips and alternate strips were limed in 1920 and a crop of sugar-cane was taken then. H. M. 602 and H. M. 337 have given better yields than R. M., but H. M. 337 flowers freely. H. M. 535 and H. M. 315 have given only fair yields but they are not so good as even R. M. H. M. 602 a variety evolved from P. OJ. 33a through a series of bud variations is very promising. It is giving high yields of cane and jaggory, is white in colour unlike the parent which is rosy red. R. M. 27-6 is a seedling of a seedling from R. M. It tillers freely and produces good jaggory. It is white in colour. and promising in many respects, but flowers freely. It is to be seen, if the time of planting is changed, whether it would stop flowering. At Veerarajapur it has not flowered at all, and probably there are many other places which may suit this white hardy, Cheni-like cane. The tests will be continued for another year at least before the low yielders are finally rejected.

The plot where these seedlings were tried was divided into six strips and the alternate strips were limed in 1920. The effect of liming was not quite evident in that year but in the second crop that was taken in 1922 it is seen that the limed plots have given comparatively lower yields than the unlimed plots. No bulky organic manure was applied to the field in 1922.

Variety	Limed plot canes per acre	Unlimed plot canes per acre	Average yield of cane per acre
R. M. ..	34·0 tons	35·6 tons	34·8 tons
H. M. 535 ..	26·4	30·4	28·4
H. M. 537 ..	23·8	21·8	22·8
H. M. 337 ..	35·0	37·2	36·1
R. M. 27/6 ..	29·4	28·8	29·1
R. M. 27/8 ..	28·6	26·4	27·5
H. M. 369 ..	14·4	10·6	17·0
H. M. 315 ..	30·2	34·4	32·3
H. M. 600 ..	13·6	14·2	13·9
H. M. 601 ..	20·4	20·0	20·2
H. M. 602 ..	33·0	40·6	36·8
H. M. 487 ..	24·8	26·6	25·7
H. M. 555 ..	17·2	17·2	17·2

Seedlings on the other Government Farms.—(1) Marthur. At Marthur H. M. 312 and H. M. 600 had made a good growth. The other canes have not given such good yields. It was proposed to scrap the rest keeping only H. M. 544 and 312 for

bulk trials. Other promising seedling canes H. M. 320 and H. M. 533 have been sent for planting during the season.

(2) *Babbur Farm.*—A very large collection of seedlings and exotic canes were tested for several years. The best of them H. M. 544 and P. O. J. 33a, were given out for bulk trials, three years ago and they have now become the main crops on the farm ousting R. M. which was not quite suitable to this area. As a large number of canes were found to be quite unfit for this tract all of them have been scrapped, only a few of the best of the seedlings H. M. 320, H. M. 553 and H. M. 602 are likely to replace P. O. J. 33a.

PRIVATE ESTATES.

Sabbanahalli, Mr. Lakshmana Reddy's Estate.—H. M. 544 has given very good results. The sandy soil seems to be well suited for it, and it seems to ripen early. Yields from 25 tons to a little over 69 tons were harvested in Mr. Lakshmana Reddy's estate. In the varietal plots H. M. 320 has given better yields than the local and H. M. 544. It looks as though these two canes are going to take the place of local cane in this locality. A large quantity of seeds of H. M. 544 were supplied to various places from here. People from Hindupur and bordering villages have already begun to take the seed out of the State.

Sravandahalli, Mr. Chikke Gowda's Estate.—The water table is very high in this locality and the soil is rich, stiff, clayey loam. A magnificent crop nearly 70 tons was found on Mr. Chikke Gowda's estate. Very heavy crops of local Rastali are taken here usually, but the seedlings have given bigger crops, more and better juice. It is said that canes do not ripen well here on the stiff soils, and quality of jaggory produced is poor and fetched a lower price in the market than that of Manchanahalli. On testing the juice of the varieties they were found to contain a lower per cent of solids even though the cane was fairly old and ready for harvest. Probably very early ripening varieties are required for this area or a proper system of manuring is required to bring about a well balanced fertility in the soil.

Shikarpur.—Cane is said to be mostly a rain fed crop here and the small wells are insufficient to keep up a field in condition during droughts. The local crop was all stunted every where, whereas H. M. 544 stood out well against adverse conditions. The drought resisting quality has made it already very popular in the locality and there was much demand for it.

Tenginakere and Keladi.—In Mr. Subrahmanya Bhatta's estate both H. M. 544 and H. M. 312 had made good growth and large quantities of seeds were available for distribution. At Keladi the germination was bad but the clumps which had grown were promising and supplied sufficient seed to continue the tests.

Ooragahalli, Mr. N. Krishna Iyengar's Estate.—There was a fair stand of the seedling crops. The plants were tall and healthy, but there were not as many canes per row as the local Pattapatti. The uniformity of the number and size of canes in local Pattapatti was remarkable. Out of the seedlings H. M. 544 and H. M. 320 had done good growth. The others were lodging badly and were doubtful in growth. But owing to an accident results were not available. Results on the bulk plots tested by the Agricultural Chemist show figures in favour of local Pattapatti. H. M. 544 had a tall healthy growth but the number of canes was small and the yield per acre was less than the local Pattapatti. Though the results give an idea as to their respective behaviour they do not answer our purpose for varietal tests since the areas were in two separate unequal parts of the field and the area under local Pattapatti was nearly three times that of H. M. 544. In the previous year H. M. 544 had given on an average of about 13·9 tons of cane over local Pattapatti. It is unsafe to draw any conclusion from the results of one year especially so when there are a number of disturbing factors. Since the cultural operations, system of manuring and drainage adopted at Ooragahalli are quite ideal, the results of experiments obtained point out the way to achieve success, but the set of conditions available here are not usually found in many places in the State. As such it is unsafe to form any conclusion which can be safely adopted in other places without preliminary trials.

New Introductions.—Through the courtesy of the Sugar Cane Expert to the Government of India a few new sugar canes were introduced from his breeding

plots at Coimbatore. Some of them are introductions from America and Australia. They have germinated well and are making good growth.

GROUNDNUTS.

In the spacing experiments as in previous years closer sowing in 6" rows has given better results than sowing in rows 12" apart. Insufficient rain in the early part of the season prevented the formation of pods and later rains produced a healthy vegetative growth and numerous pods which never reached maturity. The result was a large percentage of empty pods.

YIELDS OF PODS IN LBS.

Varieties	Field 3 Rows 12"	Field 5 Rows 6"	Field 7	
			Rows 12"	Rows 6"
Sogathoor	1299·5	1500·0	644·4	740·7
Carolina	954·5	1533·3	570·3	762·9
Barbados	920·0	1216·6	570·3	674·0
Transvaal	839·5	1600·0	562·9	703·7
Mauritius	920·0	1216·6	629·6	814·8
Virginia	989·0	1600·0	822·2	940·7
Pondicherry	1150·0	1600·0	..	..
Big Japan	1150·0	1433·0	..	..
Small Japan	429·0	716·6	..	..
Spanish	759·0	933·3	..	..
Brazil	1104·0	1433·0	..	..

Since most of the pods are borne by the setting of flowers at the nodes of branches near the stem, and later on merely the vegetative growth takes place it is better to have the plants as near as possible to get heavy yields. If they are planted too close, congestion of plants prevents healthy growth and reduces yield. From results of experiments for the last three years it looks as though a distance of 6" between rows is the suitable distance for sowing on all light sandy soils.

Variety Sogathoor	Average yield of pods per acre
Distance 3" either way	1478·8 lbs.
Distance 6"	1640·2
Distance 9"	1371·3
Distance 12"	1398·1
Distance 18"	941·0

When sown far apart if blanks take place yields are greatly reduced. On the other hand close sowing safeguards against the ravages of crows and rats. Since the plants are so close that if blanks occur adjacent plants fill up the place and bear pods.

Seed Selection.—Selection of big pods with many seeds seems to have a beneficial effect. As in previous years three-seeded pods have given good yields.

Variety sown in rows 12" apart.	Yield of pods per acre.
(a) Big Japan.—1. seeded pods	1106·4 lbs.
2. seeded pods	1383·0
3. seeded pods	1521·3

(b) 3 seeded pods selected from different percentage. Rows 12"

Variety	3 seeded from 1 seeded pods	3 seeded from 2 seeded pods	3 seeded from 3 seeded pods per acre
Big Japan	2058·0	2058·0	2646·0
Virginia	..	1764·0	2058·0
Carolina	882·0	2058·0	2058·0
Barbados	2058·0	2058·0	2940·0
Transvaal	2058·0	2058·0	2205·0
Sogathoor	2205·0	1911·0	2058·0

Bunch Virginia.—This variety was received from the United Provinces in 1921 but on growing there were no plants found in it like either Small Japan or Spanish. A fresh consignment was secured in 1922 and on growing it again, it was found to behave in the same manner. It was tested against Sogathoor and Virginia and the yields were as follows.

Variety	Yield per acre.
Virginia	1728·7 lbs.
Sogathoor	2051·4 lbs.
Bunch Virginia	1936·2 lbs.

Hybrid Ground-nut.—The Hebbal hybrid ground-nut withstood drought very well and did not get leaf-spot disease like Spanish or Small Japan. It seems to be slightly late in ripening by about a week or so, compared with the other tufted varieties. The shell of the pod is very hard and the stalk is very long. The length of the stalk being very long the pods get deeper into the ground and evade the attack of the crows. As the beak of the crow is shorter than the length on the stalk the crows cannot reach them with their beaks but only get soft earth into the mouth and nostrils if they attempt. On the other hand in tufted varieties the pods are near the surface and are within easy reach of the crows. Healthy seeds of these have been sown in this season for multiplication. As in the previous season a large number of pods were three-seeded and they were as big as pods of Big Japan or Virginia. We may be able to send out small quantities for trial in the next season.

Hybridisation Work on Ground-nut.—As a preliminary work, observation on the fertilisation and development of ground nut flowers and pods was made. It is seen that at each axil of leaf 3 to 4 flowers usually develop. In axils near the main stem all of them flower within 2 or 3 days and develop into pods. Later on the branches trail on the ground with new growth as long as there is sufficient moisture in the soil. With fresh growth new flowers and pods are formed. There is nearly an interval of five days between each flowering, thus for all the buds to flower at a leaf axil and to set it takes between 10 to 15 days. If branches trail along the ground and have a number of nodes on them, the difference of time between the setting of the flowers near the stem and those that are farther from the stem may be as much as two months. It is this habit of growth and flowering that is usually responsible for the lateness of the crop. If by accident there are late rains and the plant starts fresh growth it spells disaster. By the time the last set pods mature the early set ones germinate, or decay, or the soil gets dry and hard resulting in a large number of empty shells or pods with wrinkled, immature seeds. On the other hand in the tufted varieties the nodes of the branches are short and congested. A large number of flowers open near the base and set early. It is this habit that makes it an early crop. Since there are not many nodes creeping along the surface many flowers cannot set seed and therefore the yields are low. Flowers higher up the stems are too far off from the moist soil and the dryness of the air prevents them from setting and developing into pods. Probably slight earthing up may help to increase the yield by inducing more flowers to set. By a study of the habits of these two main types we may try to combine the characters, and build a plant that would have short node, quick flowering habit, profuse flowering at each leaf axil and such other characters that would make it hardy to withstand the rigour of our climatic conditions.

After many failures methods were found and adopted by which it was easy to emasculate as many as thirty flowers in an evening. The buds were still within the calyx in the evening but burst out of it by degrees by midnight and in the early morning by about sun rise or at dawn on warmer days, the pollen sacs burst and pollinated the stigma. Fertilisation was completed before midday was past. The flower drooped after 24 hours and in 48 hours it was withered. The stalk of the ovary began to elongate in 72 hours and the growth was quite visible to the naked eye on the 4th or 5th day. The complete development of the pod took place in 60 to 62 days after fertilisation. With this knowledge it was easy to continue the work. Usually emasculation was done between 5 P.M. and mid-night and in the next morning pollen from the male was taken and placed on the stigma between 6 A.M. and 7 A.M.

Small Japan and Virginia were selected for the following reasons. Small Japan is an early maturer, possesses uniform and attractive seeds having high

percentage of oil, and being a bunch variety it can be easily harvested. On the other hand Virginia has big pods and has a vigorous growth but bears many empty pods. To combine the good characters of both and evolve a good variety was the object. Between 11th and 20th August 199 flowers of Small Japan were emasculated and pollinated with the pollen of Virginia. Three reciprocal crosses were made. From those crosses 265 seeds were secured. On sowing them 98 seeds germinated but only 57 plants were found to be successful crosses. Of the reciprocal crosses only one was successful. It was a very happy coincidence to find that the dominant characters were all desirable ones. It will now be only a question of time to isolate the particular plant we require from the large number of plants that are going to segregate into various groups in the succeeding generations.

If the main characters are only considered, there would be eight characters in which they differ as follows:—

Small Japan	Virginia
1. Bunch type—t.	1. Trailing type—T.
2. Small pods—p.	2. Big pods—P.
3. Red seeded coat—R.	3. Rosy seed coat—r.
4. High per cent of oil.	4. Low per cent of oil.
5. Early type.	5. Late type—E.
6. Pale green leaf—g.	6. Dark green leaf—G.
7. Short nodes.	7. Long nodes.
8. Short stalked flowers.	8. Long stalked flowers.

The hybrid that has been secured is trailing in habit possesses dark green leaf and big pods with red seed coat. The nodes are short and the flower stalks also are short. The ripening period is a little more than that of Small Japan.

Thus by taking only the main characters the hybrid possesses three dominant characters from the male parent and one from the female parent. It may be represented thus (differing in four characters) Tt. Rr. Pp. Gg.

Out of this the following are the probable segregations we may be able to get in the next generation, namely the product of the following (T^2 2Tt t^2) (R^2 2Rr, r^2) (P^2, 2 Gg, g^2).

Similarly if all the characters are taken into consideration we may get a large number of combinations and out of them a large number of new types will evolve. The chances are we will get a few desirable plants out of them to suit our requirements.

If the pairs of characters are—n the groups we get are 2n. the new combinations will be 2n—2.

Here we have 8 pairs then the grouping will be 256; new combinations will be 254.

Out of 256 combinations that take place new combinations may be 254 and the desirable ones are the following only:—

1 Trailing red seeded, big podded, dark green plant.
4 Trailing rosy seeded, big podded dark green plant.
5 Tufted, red seeded big podded dark green plant.
11 Tufted, rosy seeded, big podded dark green plant.

After isolating the required pure types from the various groups that segregate in the succeeding generation we try to combine with them any other character we wish to have by further hybridisation. The F2 generation is now being grown and the various groups of segregating are being carefully watched. Some ideal tufted and trailing plants have been already secured.

The local Sogathoor is really an acclimatised exotic type, but the real local groundnut is a hardy, pale green, hairy leaved, late maturing variety with thin pods having thin shell and many seeds. Three seeds are very common, but 4 and 5 in a pod are not rare. It is poor in oil and has long noded stems. The yields being very low, it has gone out of cultivation almost every where. Since it is valued for its taste as "fried nut" it has some local demand. Attempts are being made in the present season to hybridise this with Small Japan and other productive varieties having more oil.

Potato.

In October 1922, Dr. Coleman observed potato flowering freely near Arkalgud and proposed to start seedling work on potatoes to evolve varieties to withstand the "Ring Disease" which is causing great loss annually. Since we have not successfully introduced any exotic variety to withstand the Ring disease, it has become urgent to evolve varieties to stop the havoc of this fell disease. The area is slowly falling off and there are hardly 5,000 acres under potato in the State. If some disease resisting varieties are evolved, not only the area would extend but also an impetus will be given to the export trade we have already developed. Since 1886, attempts have been made by the Government to introduce new varieties. The present varieties grown in the State are all the results of such attempts. Potato does not flower freely here every season. There is some flowering during the rainy season and cases have been observed when the flowerings have set fruit and some seed. Flowering was fairly common round about Hebbal and advantage of this was taken to start the work. Attempts were made to pollinate some flowers in Ricketts but they all failed. A further search in the villages showed that both the local Potato and the Ricketts were freely flowering and in many cases plums or fruits were developing. On examination it was found that the fruits of Ricketts contained no seeds and it was a pure case of parhenocarpy. Similar instances are often come across in Tomato. On the other hand a large number of local Potato fruits were healthy and contained plenty of seeds. By keeping special watch over some plants in a few gardens for a month after the plots were harvested some half ripe fruits were obtained. Our thanks are due to many garden owners for having given us facilities for procuring the fruits. We could not leave the fruits on the plants till fully ripe as the ring disease was killing off the crop badly in most of the gardens. From the fruits collected about 17·35 grams of seeds were obtained. The first batch of six plants germinated on 22nd October 1922. In four days they began to germinate and in 13 days nearly 32·2 per cent of seeds had germinated. These preliminary trials being successful all the seeds were sown on moist soft soil and covered by a thin layer of fine sand under glass bell jars. Between 9,000 to 10,000 seeds germinated. In about three weeks tuber stolons began to form in the best developed plants. They were all pricked into ground or pots and then removed to Hebbal Farm for planting.

As most of the Farm soils are infected with ring disease a new well was dug in the dry lands and a small area was converted into a garden land for the first time. The seedlings were all planted here in 3 feet rows. A very large number of plants were all cut away by mole crickets. By damping off and by the attack of a small caterpillar, a large number of seedlings were lost in the nursery. There were hardly over 4,000 plants fit for planting. And out of them, many were attacked by Alternaria. The season being very dry and the soil being newly brought under irrigation, the general growth was not satisfactory. But the most interesting thing was that the vigorous rank growers had practically no tubers, whereas small plants barely six inches or even less in height had a number of tubers. By March most of the plants were harvested. A very large number of them have given good tubers. The variations in the seedling are enormous. The most important variations were as follows :—

1.	Vigour of plant	.. Short, medium, spreading and tall.
2.	Colour of stem	.. Green and violet.
3.	Colour of tubers	.. Pale yellow, brownish yellow and rosy white.
4.	Form of tubers	.. Irregular, round, kidney-shaped and cylindrical.
5.	Size	.. Small, medium and big.
6.	Productivity	.. Few and more.
7.	Appearance of the surface of the tuber	.. Smooth, slightly pitted, pitted.
8.	Ripening period	.. Early, medium or late.
9.	Colour of flesh	.. White, deep yellow, light yellow.

In these combinations, we have various types to select. A few of them are quite good and look very much like the famous Burbank's potato. If some would withstand the ring disease, or are capable of growing under dry land conditions in the rainy season, or can be grown under warmer climatic conditions than that of the Bangalore-Kolar highlands, there would arise in future untold possibilities for various industrial activities. At least fair crops of potatoes on large areas would

be an insurance against any impending famine. If perchance types which can be grown on the plains are come across the result will be of immense economic value and will to a great extent solve the food problem of the masses all over India. A new simple method has been discovered to procure easily disease free potatoes.

Castors.—Work on castors was continued. As space was not available they were sown in 3 feet rows and Velvet Beans were sown between the rows:—

BULK TRIALS.

Varieties.	Yield per acre in lbs.
H. 1	582·6
H. 2	505·0
H. 3	537·2
H. 4	536·2
H. 5	530·0
H. 6	437·4
H. 7	449·5
H. 8	303·4
H. 9	288·2
H. 10	247·9
H. 11	502·9
H. 12	582·6
H. 13	584·6
H. 14	438·4

FRESH SELECTIONS.

H. 16	964·16
H. 17	900·94
H. 18	915·27

Out of the 54 District types tested only three were found to be fair yielders.

Settihalli-Turvekere	514·2
Chitaldrug-small	535·4
Giddanahalli	511·2

Reports regarding castor trials have not been received. From 1 or 2 experiments, favourable opinion has been expressed regarding the drought resisting qualities of some types. Avares were not collected and the single type grown was not satisfactory.

Fodder grasses and Legumes.—Fodder grasses both indigenous and exotic were continued. Natal grass seems to be well fitted for poor dry soils. Velvet beans have been giving very high yields of beans per acre. Probably it deserves a better recognition as feed for cattle since none of the local legumes give such high yields.

White seeded type gave 2·432 lbs. per acre.
Black seeded type gave 2·478 lbs. ,,

Experiments to find out the optimum distance for planting lucerne and sun-flower have been started. In every case the results are in favour of closer sowing.

Laboratory work.—Various methods were tried for testing the viability of pollen grains of different plants. Testing ragi pollen in the glass cell with the help of air saturated with moisture has become our standard method. The same method is successful for testing pollen of ground-nut and *togare*, but it did not succeed with cotton pollen.

Dr. Balls suggests 2 per cent cane-sugar solution for testing cotton pollen. Cane-sugar solutions from 1 per cent up to 75 per cent were tried. Up to about 30 per cent strength the grains freely burst and in more concentrated ones they lie dormant. The same was the case when gelatin and agar-agar were added to sugar solution. Using glucose only instead of cane-sugar was also not successful. Dusting pollen on moistened gelatin film merely bursts the grains. Olive oil has been used by E. P. Sandsten (Madison, Wisconsin) as a medium for germinating Phaseolus multiflorus. Working on this suggestion various indigenous oils were used as media for germinating cotton pollen. For the first time a few grains germinated in gingelly oil. It is now found that cold drawn castor oil is the best

for this work. A drop of oil dusted over with pollen and placed over a glass cell containing a bit of moist filter paper will in about 2 hours start a number of pollen grains to germinate. Pollen grains placed in a covered glass dish for over 24 hours were found to germinate freely within ten minutes. It is now possible with the help of this method to test the pollen used for hybridising flowers and also to find out easily the stages when pollen has to be taken out, and how best, and how long it can be preserved and under different conditions in different seasons. A knowledge of these factors will greatly increase the percentage of success in hybridisation work.

A number of potato varieties were tested for their S. G. and the distribution of internal and external medula which give an indication of their starch contents.

Paddy.—Since all paddy. varieties had become badly mixed, ear heads were selected at the time of harvest to procure enough of seeds to get pure plots in the next season. Incidentally a number of plant selections were made. Varietal studies of the most important types of Mysore paddies has been started at Hebbal.

School work.—The students had plenty of work in grafting and pruning. Nearly 200 guava grafts are now available for sale. The class work of third and second year classes were taken as in previous years.

I have great pleasure in bringing to the notice of the Director the willingness with which the staff of the section has shouldered the extra heavy work, and the good work turned out by them.

V. K. BADAMI,
Senior Assistant Botanist.

The Report of work done on the Government Experimental Farm, Hiriyur, for the year 1922-23.

Seasonal Conditions.—The rainfall for the year was almost the same as last year, but, being better distributed, was more favourable for crops. The months of April, May and June which usually go without rain had a receipt of 3 inches, whose beneficial influence was felt by the sugar-cane crop. The months of October and November, as usual, were the heaviest months getting 7·75 and 4·09 inches respectively.

Farm Buildings.—Though wood materials and tiles for the quarters of Agricultural Inspectors were purchased long ago, for want of funds, the work of re-roofing the quarters was not taken on hand. The permanent furnace for jaggory boiling which is half-done, remains, for the same reason, in the same condition. It has not been possible to attend even to repairs for Farm buildings though all of them require repairs very badly. The difficulty of boiling jaggory in detached temporary sheds with store-house about two furlongs away has made supervision difficult and consequently affects adversely the efficient handling of labour.

Farm Machinery.—No new machine was got during the year, except the loan of a Massey Harris Power chaff-cutter from the Live Stock Section. This was worked with the help of the tractor for cutting jola stalks for ensilage. As we had no big stock of green fodder a small pit 49 c.yds. (18′ diameter x 6′-11″ average height) was used. The work done was quite good. The pit was opened after seven months and though a few bullocks refused to eat the stuff, the majority of them relished it, especially the breeding bull which ate it with avidity.

The Mill Pulley of Massey-make was increased in diameter by ½ a foot by wooden extension. This has contributed to raising the extraction by 3 per cent, *i.e.*, the mill which was giving an extraction of 60 per cent with J. 33a is giving now an extraction of 62-64 per cent. The engine is able to run more satisfactorily though it cannot run at full load of the mill.

The tractor was out of commission for nearly 8 months during the year. As the cost of working it with the plough was very high, its performance was limited to discing the land during its working period. The plough bottoms which were sent by the makers and which were on show during the last Conference have not been much used and so no data can be given about their working, but they are, I think, really an improvement over the model supplied first. They have met many of the objections raised in my last year's report. Report will be submitted as to their working efficiency during next year.

I may be permitted to emphasise the fact that the tractor has not from the time it was purchased come up to the level of our expectation. In my experience, the period of its strike is more than its willing work, so much so that I have been very badly let down during busy seasons many a time. This is an experience which is not profitable to ignore.

The cotton gins are being used more and more every year by neighbouring raiyats to get their *kappas* ginned. The following table shows the number of maunds of raiyats' cotton ginned every year.

Year	No. of maunds ginned		Amount realised	Remarks
	Mds.	lbs.	Rs. a. p.	
1916—17	..	..	.....	
1917—18	..	..	.....	
1918—19	..	..	.....	
1919—20	230	8	33 9 4	
1920—21	960	18	122 4 4	*Ginning will go on for another month.
1921—22	1,135	18	141 15 11	
1922—23	3,114	..	704 14 0*	

By increasing the diameter of the transmission pulley, *i.e.*, by increasing the number of revolutions of the gin shafts, the output has been considerably increased. The present output of the two double roll gins per hour is 3 maunds lint of Cambodia and 6

maunds lint *Sanhatti*, whereas previously its output was 2 maunds lint of Cambodia cotton and 4 maunds of Sanhatti.

It may be pointed out in this connection that on account of working the gins, demand for good seed to sow more than 10,000 acres has been met. Though the seed is not from a selection, the fact that it is far superior to what the raiyats could get at Davangere, being free from Dodhatti and other seeds, should not be lost sight of. Those that had grown pure crops from our selection seed got their *kappas* ginned on the Farm, and the area that will be sown with the improved farm strain will be not less than 600 acres in the neighbourhood.

Cattle.—There were six pairs of working animals, as in the last year and they kept up good health throughout. Due to breakdown of the tractor, unusually heavy work was got out of them. This with their advancing age, as many of the bullocks have not been replaced from the time the Farm was started, will, it is feared, make the animals less efficient during the next year. It is necessary that fresh pairs should be purchased.

The breeding bull continued to do its work. The total number of coverings is 28, and cows from 10 miles distance have been brought to be put to the bull. Though this is by no means a good performance I might say that it is an improvement over last year. A younger and a keener bull would really prove more popular.

Dry-land.—As was reported last year, ploughing of the portion of the dry-land infested with Hariyali was taken on hand and finished this year. The tractor was tried with the self-lift plough. The work was most unsatisfactory even with a single bottom, the plough not cutting even 8" deep. The tractor was tried with the Gallows plough, but the power was found insufficient. Five pairs of the Farm bullocks were set to the work and 11½ acres were ploughed in 32 days.

Crops.—As usual *Sanhatti* and *Bile Jola* were the main crops, with Bengal-gram in *kattes* and safflower all round the border.

Sanhatti was sown again late for want of timely rains on 10th October 1922. The crop was not good. The yield of cotton works out to about 5 maunds 11 lbs. per acre. The yield of Selection 45, due to being sown on shallow, uneven land, is 3 mds. 12 lbs. per acre. Selection 69 has proved better and gives an yield of 7½ mds per acre. The ginning percentage of Selections 69 and 45 is 27 and 26·6 respectively. The area under Selection 69 was 9 acres and Selection 45, 10 acres (*Vide* statement I attached.)

Spacing experiments were conducted with Sanhatti Selection 69 on same lines as in last year. The following table shows the yields.

Series	2 feet rows			3 feet rows		
	Area	Yield in maunds	Per acre	Area	Yield in maunds	Per acre maunds
I. Selection 69 ..	0·50	1—8	2—16	0·50	1—21	3—14
II. Selection 69 ..	0·50	5—8	10—16	0·50	3— 2	6— 4
III. Selection 69 ..	0·50	4—8	8—16	0·50	3—25	7—22
			7— 6 Average			5—22 Average

This is the first year when two feet apart sowing has given a higher yield. This experiment has therefore to be continued for another year at least before any definite opinion can be given.

Cylinder experiments with cotton and jola were conducted by the Agricultural Chemist.

Jola.—Bile Jola was grown on 36 acres in all, of which about 5 acres were very bad, the land being gravelly and shallow. There was a severe attack of fly-borer in the young stage of the crop, but the crop did not suffer much. The yield of jola was 44 *pallas* which works out to 122 seers per acre. The straw weighed 11½ tons.

Bengal-gram and safflower were minor crops which gave 66 seers and 124 seers respectively.

Wet land.—The main crops are sugar-cane, Cambodia cotton and plantains. A four acre plot was leased out for paddy growing on share system. Green manure crops were grown as usual. Drainage of the wet land was improved vastly to which was due largely the good stand of sugar-cane. Drainage can be definitely said to be a very powerful controlling factor in our lands. On the whole, it may be said that the land has improved considerably in its physical condition due to drainage and green manuring as is seen from crop yields.

Sugar-cane.—Though this is the main crop on the wet land, the area occupied by it was about half of last year. Only 13¾ acres were planted to cane, of which seedling canes occupied 1½ acres and varietal tests occupied 1 acre, leaving 5·26 acres of H. M. 544 and 6 acres of J. 33a. The crop was a very good, one giving on an average 24·4 tons of clean cane to the acre. On certain portions, the yield went up to 40 tons to the acre, but such areas were small. Of the bulk crop H. M. 544 looked to be better than J. 33a, but due to heavy lodging and the sprouting of eyebuds the brix was about 2 per cent less than in J. 33a. Propping was attempted, but did not help much as the season was advanced and the crop had lodged heavily, resulting in breaking of clumps of cane. H. M. 544 compared with J. 33a looks to be more delicate, demanding more intensive cultivation such as wrapping and propping and hence it is doubtful if it can be grown on a large scale under labour scarcity conditions as here. It is gratifying to be able to report that the receipt of jaggory from 13¾ acres has exceeded the total yield of 25 acres of 1921-22 (*vide* statement 11 for yields).

The area under cane for the year 1923-24 is 25 acres and is a promising crop. One factor worth noting is that only tops and setts from the top 3rd. of cane were used for planting, which resulted in giving very good germination.

Borer experiments were conducted by the Senior Assistant Entomologist and except two plots which were near old cane plot and which were planted rather late, the rest of the crop is almost free from borer.

Varietal tests of cane.—The 3 varieties J. 33a, H. M. 544, and Red Mauritius were tested in alternate strips repeated, as usual; 3 times to allow for soil variation and the following are the yields.

Name of variety	Area of 3 series in acres	Yield in tons of cane	Per acre in tons
J. 33a	0·30	10-8-2-4	35·7
H. M. 544	0·30	10-14-1-14	34·7
Red Mauritius	0·40	13-7-2-18	33·4

Manurial experiments were conducted on the same lines as in the previous years, and the results will find a place in the report of the Chemical Section.

The white sport from J. 33a, occupied this year an area of 1½ acres. Striped sport canes from Red Mauritius have been multiplied and planted in a small area in the seedling cane plot.

Seedling Canes.—These were tested as usual and many of the unimportant ones have been rejected.

Jaggory boiling.—Total number of tons of cane milled was 285; 2,136 maunds of jaggory were got which works out to 9·3 per cent. The proportion of cane to jaggory is appreciably more than last year, due to the fact that there was better extraction of juice and also to high per cent of brix in J. 33a, which, during certain period, came up to 22 per cent. No tests with furnaces could be made for want of labour. The big round pan of 9′ diameter is very efficient, in that it gives three charges per day each charge weighing nearly ten maunds. But it is very heavy for easy manipulation, specially at striking time.

Cambodia cotton.—The total area was 16·99 acres of which 7·49 acres were sown early, *i.e.*, first week of July 1922 and the other area in the second week of August 1922. The early sown crop was badly attacked by the cotton boll-borer and we lost the first crop, the plants recovering after rains. The later sown crop grew very well but even there the first bolls all dropped off. As will be seen from Table III, the late sowing is decidedly a better season for sowing cotton under irrigation.

Green Manure Crops.—A mixture of sunnhemp and cowpeas has become the usual practice on the Farm. The crop was good giving as much as 10,000 lbs. of green matter to be ploughed in per acre. The use of heavy drag chain tied to the wheels of the Gallows plough to weigh sunnhemp down to facilitate ploughing in of a standing crop of sunnhemp was found to be very successful. Since the green manure could not be ploughed in time, due to break down of the tractor, the crop had seeded so much that after the cane setts were planted in the furrows, there was a very good stand of sunnhemp threatening to smother the young cane. In-as-much as this kept down other weeds, it is worth sowing seed of sunnhemp before planting cane and then pull out the plants and allow to rot which forms an additional source of manure.

Sunnhemp as a green manure for wet land was foreign to this tract, but its utility in improving the soil has been seen by the neighbouring raiyats on the Farm, and the area under green manure is spreading. It may be estimated that there were more than 300 acres under green manure crops under Marikanive.

Plantains.—As reported in my last year's report, plantains were planted on about 7¾ acres and 6,715 in number. Varietal tests with Rasabale, Mauritius and the cooking variety are conducted. The bulk crop is Poovan, a handy variety of Salem. Four varieties are under test. Except Poovan all the others suffer much from fruit-rot, especially Rasabale and the cooking variety. Specimens have been sent to the Mycologist for investigation. Poovan seems to be a very hardy variety, doing well even under trying conditions. The yields of different varieties are not ready yet. Three hundred and seventy-five cocoanuts were planted in the plantain plot as reported last year. Since the land chosen was a very bad one the present stand of the crop can be said to be satisfactory.

Paddy.— As noted above, a plot of 4 acres was leased out to be grown with paddy. It was arranged with the cultivator to lay out small plots for manurial tests. The plan is shown below. The yields are rather striking in favour of bone-meal and groundnut cake. Potash does not seem to influence this crop as in the case of sugar-cane on our Farm lands, it seems to have a depressing effect on the yield of grain.

Bone-meal	plus Groundnut cake	...	Check	Bone-meal	plus Groundnut cake	...	Check
,,	plus C. plus K	...	,,	,,	plus C. plus K	...	,,
,,	plus C	...	,,	,,	plus C	...	,,
,,	plus C. plus K	...	,,	,,	plus C. plus K	...	,,
,,	plus C	...	,,	,,	plus C	...	,,
,,	plus C. plus C	...	,,	,,	plus C. plus K	...	,,

Manurial dose given—

140 lbs. bone-meal per acre.
180 lbs. groundnut cake per acre.
50 lbs. potassium sulphate per acre.

Average yield of check plots per acre is 13 pallas.

Average yield of B. M. plus C. plus K. is 15 pallas.

Average yield of B. M. plus C. is 21 pallas.

One hundred and forty lbs. bone-meal plus 180 lbs. groundnut cake, which is the acre dose, costs Rs. 20. The profit on 8 pallas per acre, which is excess receipt of paddy over check, is about Rs. 56, net profit being Rs. 36.

Seed distribution.—One hundred and ninety-four maunds of Cambodia cotton seed to sow 776 acres, 110 mds. of Sanhatti Selection 69 to sow 440 acres, 58,974 sugarcane setts of H. M. 544 to plant about 6 acres and 16,000 setts of J. 33a, to plant about 2 acres were distributed. More than 50 villages have been directly influenced by the distribution of the Farm seed.

Visitors.—The Dewan of Mysore visited the Farm during the year. The District Agricultural Sub-Committee met on the Farm during April 1923. The members were keenly interested in our work.

K. M. GURURAJA RAO,
Farm Manager, Babbur.

STATEMENT I.—Showing the yields of Sanhatti.

No.	Variety	Area in acres	Yield in maunds	Per acre	Remarks
1	Selection 45	10	34—17	3—12	
2	Selection 69	9	68— 0	7—15	
	Total ...	19	102—17	5—11	

STATEMENT II.—Showing the yields of sugar-cane crop in different plots.

No.	Plot No.	Variety	Area in acres	Yield of clean cane in tons (actual)	Yield of jaggory in mds. (actual)	Yield of cane calculated per acre in tons	Yield of jaggory calculated per acre in mds.	Remarks
1	517	H. M. 544 ...	2—26	53—12	294— 6	23— 5	164— 4*	* The figures in the last col. are calculated on percentage basis.
2	518	„ 544 ...	2—50	55— 4	374—12	22—08	173—10	
3	518, 519	H. M. 544 J. 33a and Red, Mauritius.	5— 0	131— 1½	813— 9	26— 4	182—18	
4	524	H. M. 544 ...	0—50	12— 8¾	39—18	24— 8	219— 0	
5	524	J. 33a ...	2— 0	55— 0	444—15	26— 4	222— 7	
6	515	Seedling canes ...	1—50	29— 8¾	160— 0	19— 4	132— 0	
		Total ...	13—76	336—15	2,136— 4	24—48	183—42	

N. B.—Fifty-one and three-quarter tons of cane used up for setts for planting on the farm and for sale outside. Therefore only 285 tons were milled.

STATEMENT III.—Showing the yield of Cambodia cotton for 1922-23.

No.	Plot No.	Date of sowing.	Area	Kappas in maunds	Yield in mds. calculated per acre	Remarks
1	509	4-7-22	4·20	50—15	12— 0	
2	508	5-7-22	3·29	43—26	13— 9	
3	262-502 ...	9-8-22	6·50	147—24	22—20	
4	503-504 portion of Botany section plot.	22-8-22	3·00	34—13	11—13	Clayey portion.
	Total ...	...	16·99	276—22	16—28	

Report of the Agricultural School, Hebbal, for 1922-23.

The most important change that has come about during the year under review has been the opening of the third year's classes in Agriculture and the decision to award the Licentiateship in Agriculture to the successful students. Consequently, there was no final examination or the awarding of prizes and diplomas to the successful students of the school.

The school began on 3rd July 1922 with a total number of 22 students on the rolls, distributed as per the tabular statement given below, which also shows the number that entered after the school began, its regular terms as well as those who left the school. The present number of students on the rolls is 23.

Class	No. of students who entered at the beginning of the year	No. subsequently joined	Total	No. left	Present strength	Remarks
1	5	3	8	1	7	Sent away from school for continued absence.
2	4	..	4	1	3	Left the school as the student could not cope with the hard practical work.
3	13	..	13	..	13	

Of these students, three are in receipt of merit scholarships each of the value of Rs. 15 per month, ten are in receipt of Government scholarships of the value of Rs. 10 each per month, four are in receipt of the scholarships of a similar value one from each of the District Boards of Shimoga, Mysore, Hassan and Bangalore, the rest provide their own funds for expenses here. The students have taken over charge of the management of the hostel which is now managed by a Committee of five consisting of the Vice Principal, the Warden and one student to be elected from each year's class. In spite of occasional errors of judgment, they have got along splendidly in this new type of work which shows that they have learnt the lessons of co-operation, organisation and self-sacrifice for a common cause to a marked degree.

Two students have been taken in as special students and one of them has finished his course in manufacturing jaggory while the other student is still staying on the Farm learning Agriculture.

The extra scholastic activities of the students have been as usual varied. They took an active part in laying out the new cricket pitch on which they have won laurels on many occasions. When they had to yield to stronger teams from outside, they have done it so gracefully that the bonds of athletic brotherhood were strengthened in every case. They have conducted a tennis tournament to a successful close and have invited all the officers of the Agricultural Department to a friendly contest. When the weather was favourable, they have played football and badminton and when the weather was against them, they have amused themselves with indoor games. The students have also successfully celebrated the annual School Day and organised a successful function on the eve of Dr. Coleman's departure. Mr. V. K. Badami has been able to organize a senior scout troop which consists of 16 members who have been duly registered at the Scout headquarters. Swimming classes have been held during extra hours and now almost all the students know how to save themselves from drowning, while some have become fairly expert at the game. Three paper chases have been organised and successfully brought to a close, the Debating Society has been active as usual holding 15 meetings this year, and the Block Gardens worked up again in spite of the difficulties that lay in the way of drawing water from a deep well. It may be remarked that all these activities have not interfered either with their enthusiasm for further studies as may be seen from a desire on the part of five students of the third year's class to undergo postgraduate training in some of the subjects.

Owing to an outbreak of plague in the village, the school was closed in the second term about two weeks earlier than usual necessitating a corresponding

lengthening of the third term. In spite of the fatigue involved in working in the fields during the hot seasons, the students have borne it cheerfully and have been trying their best to keep attendance at all the practical classes.

The annual examinations of the school were held from 7th May except the diploma examination in Agriculture which was arranged to be held on the 26th April 1923 to suit the convenience of the foreign examiners. The foreign examiners for the diploma examination were Mr. D. Balakrishnamurthy of the Coimbatore Agricultural College for Agriculture, Mr. E. J. Bruen of Bombay for Live Stock, Mr. E. K. Ramaswami of the Engineering College, Bangalore, for Engineering, and Major Simpson of the Civil Veterinary Department, Bangalore, for Veterinary. All the 13 students of the Diploma class got their degrees of L.Ag., on 30th May 1923 under the Presidentship of Dr. M. O. Forster, Director of Indian Institute of Science, Bangalore. Among these 13 degree holders, Mr. Y. R. Narayana Rao has elected to take up postgraduate study in "Farm Crops and Farm Management" having satisfied all the prescribed conditions.

In the School Board meeting held on 4th June 1923 all the first and second year class students were declared eligible for promotions to the next higher classes except H. R. Sundaresan of the first year class who was to undergo an examination in all the subjects a week after the re-opening of the school on 2nd July 1923 on the result of which depended his promotion or otherwise, since he was away from attending the regular annual examination along with other students.

The entrance examination of the school for the session 1923-24 was held in all the headquarters of the Districts and in the office of the Director of Agriculture in Mysore, Bangalore, on 20th June 1923 and 18 were declared eligible for entrance into the first year class.

Report of the Hebbal Agricultural Farm for 1922-23.

The major part of the work on the Farm was carried on on the same general lines as followed hitherto, and the results, while varying in detail, have on the whole, been consistent. Incidentally it may be remarked that the wet area crops suffered considerably during the earlier part of the season owing to the lack of water in the tank and part of the variation in results may be due to this initial checking of the growth of the crops. The statements submitted herewith give the detailed data on the various experiments conducted on the Farm in both the wet and dry areas. From these, the following tentative conclusions may be drawn.

Sugar-cane.—The addition of superphosphate at 3 cwts. per acre did not give any appreciable increase over the check plots. In the spacing tests, 3-ft. spacing has done better than either 2-ft. or 4-ft. spacing. The experiments on wrapping are not very conclusive as it has done better in two cases and gave the opposite result in the third case. This experiment has to be continued for some time longer for obtaining definite results. With regard to the varietals, H. M. 544 has done well in one range and H. M. 320 in the other both being better than Red Mauritius which was used as a check in each case. This year the experiment has been laid out on a checkboard basis to obtain information on the relative merits of some of these varieties under practically identical conditions which will also indicate whether the yield has been affected by variations in the soil in different parts of the given range. The experiments on fertilisers are being carried on on the same lines except that Nitrolim has been added as a fertiliser for experimental trials.

Paddy.—With regard to the varieties, Alur Sanna has done well and Kaddi bhatta has also come up both in the yield of straw and grain. In some of the varieties which are apparently more exacting in their water requirements, the straw has been heavy although the grain yield has been very low. With regard to the District varieties, several of them have done well and the experiment with these may be continued some time longer. The age of seedlings test has given the same result. On the whole, the 25 days seedlings have given a better yield of grain. The duty of water experiments have given figures for which no explanation can be given and it is unfortunate that this work could not be carried out during the summer season owing to the lack of an engine and pump. With regard to the seed rate tests 30

seers rate has given better result although the 40 seers has given more straw. A small amount of seed of different varieties obtained from Java is also being tried and if any of them should prove suitable, they will be multiplied and tested against the existing varieties.

Ragi.—With regard to the selection experiments on this crop, salt water selection has given the best yield although the relative differences are not very marked. Sunnhemp as a green manure has also given high yields of ragi both in straw and grain. With regard to the different methods of sowing, the results are not striking although there is a slight advantage in favour of Hak sowing. If the cost of the different methods of sowing is to be added to the figures furnished, the Hak sowing will probably show up to even better light. Of the varietal trials H. 22 has done poor and practically all the varieties tried including the local have done better. H. 3 has done best in this series although H. 32 has given a higher yield in Range J. The check yield also is very much higher and hence the relative merit of H. 33 over the check is very little as compared with H. 13. With regard to the trial of artificial nitrogenous manures both castor cake and ammonium sulphate have given the same yields, but the experiment has to be continued sometime longer before any conclusions can be drawn with regard to the effect of artificial manures: super has given very good results both in grain and straw. While further experiments are necessary to establish the fact, it seems likely that potash fertilizers are not very essential for successful growth of ragi crop on the Farm.

Groundnut and other miscellaneous crops.—The varieties that have done well were Transvaal and Sogatur both coming very close to each other in yields. Togari from Kadur has given very high yields. With regard to the cotton crop the locality is not suited for trials of this crop and it is proposed to abandon trials of this crop except for teaching purposes.

In conclusion, I wish to express my thanks to the staff and servants of the Farm who have worked very loyally in spite of the difficulties involved owing to an unfortunate outbreak of plague in the village.

Results of Sugar-cane Experiments for 1922-23.

		tons.
Manurials.—1 ton cake plus 250 lbs. Am2S04	... ...	46·58
1 ton cake plus 250 lbs. Am2S04 plus super 3 cwts	...	46·04
Spacing tests.—2 feet Wrapped	... ...	31·47
Unwrapped	... ...	32·89
3 feet Wrapped	... ...	34·25
Unwrapped	... ...	33·12
4 feet Wrapped	... ...	31·93
Unwrapped	... ...	29·39

Range A.—Yields of two side rows only.

Variety	Cake	Cake plus Am PhO.
	tons.	tons.
H. M. 544	47·40	42·26
H. M. 312	37·54	39·21
Red Mauritius	39·17	41·61
Local striped	20·00	19·33
J. 33 A	39·11	41·01

	Cake.	Cake plus Am2 S04
	tons.	tons.
Red Mauritius	36·68	41·87
H. M. 320	47·19	45·84
H. M. 313	38·36	40·92
H. M. 332	39·09	42·75
H. M. 553	34·87	40·53

Varieties Range A.—Yields of central rows only.

	Cake	Cake plus Am PhO.
Local striped	26·51 tons. 244 mds.	24·61 tons. 229·47 mds.
Red Mauritius	39·65 tons. 380·47 mds.	40·41 tons. 313·71 mds.

	Cake	Cake plus Am PhO.
J. 33 A.	36·18 tons. 308·00 mds.	35·00 tons. 319·52 mds.
H. M. 312	35·29 tons. 331·00 mds.	32·13 tons. 281·76 mds.
H. M. 544	42·15 tons. 392·14 mds.	41·71 tons. 395·00 mds.

Range B.—Results of central rows only.

	Cake	Cake plus Am2 SO4.
H. M. 320	39·42 tons. 390·65 mds.	43·59 tons. 444·98 mds.
H. M. 332	36·58 tons. 302·12 mds.	43·59 tons. 398·42 mds.
H. M. 313	35·90 tons. 307·87 mds.	44·16 tons. 465·68 mds.
H. M. 553	36·9 tons. 315·48 mds.	37·94 tons. 323·39 mds.
Red Mauritius	31·17 tons. 250·95 mds.	45·69 mds. 420·41 mds.

Acre Yield Calculation of Paddy Experiments.

Variety	Grain	Straw.
	lbs.	lbs.
Garike Sanna	535	2,180
Budnar sanna	633	2,300
Banku	940	1,130
Kadapapisanam	477	630
Alur Sanna	1,214	1,260
Kaddibhatta	1,357	1,450

District Varieties.

	lbs.	lbs.
Chandragutti	1,050	1 160
Puttubhatta	1,300	1·620
Kavade Dodda	740	1,100
Sannabhatta	630	,940
Hasadibhatta	975	1,680
Three months paddy	310	600
Kesaribhatta	1,800	2,480
Kesari	1,300	1,520
Dannasale	1,420	2,160
Gunsale	1,330	1,227
Bile Mallige	1,540	1,200
Bile Dappabhatta	1,340	1,260

Age of Seedling tests. Variety Dodbele.

	lbs.	lbs.
25 days old	1,080	1,690
35 days old	852	1,633
45 days old	900	1,460

Duty of Water Experiments. Variety Dodbele.

	lbs.	lbs.
Irrigated once in three days ...	2,380	3,720
Irrigated once in five days ...	1,820	2,720
Irrigated whenever wanted ...	1,980	4,520
Dodbele bulk	1,426	1,760
Dodbele general manurial bulk trial ...	1,470	1,895
Bulk trial of Dodbele fertilizer plots ...	840	1,632

Seed Rate Tests.

	lbs.	lbs.
12 seers	1,280	2,200
20 seers	1,390	2,300
30 seers	1,860	2,340
40 seers	1,240	2,450

Fodder Jola.

			lbs.	
Spacing 22-25	...	...	39,700	per acre kaki jola.
Variety 26-29	...	...	23,450	,, ,,
B range variety 29-32	...	...	22,230	,, ,,
Do 20-24	...	...	6,170	,, Sundia Jola.
A range 10-17	Cowpea	...	3,070	2nd crop.
Do	,,	...	9,625	1st crop applied to paddy plots.
A range 22-25	,,	...	2,980	Applied to C & D Fertilizer plots.
A range 26-29	,,	...	2,490	

Results of Ragi and other Crops, 1922-23.

Ragi manurial experiments.—Range B. Variety H. 22.

Treatment.			Grain. lbs.	Straw. lbs.
Check	...	...	702	896
Cattle manure	...	...	812	1,333
Honge cake	...	...	857	1,157
Cowpea	...	...	8,43·25	1,150·5
Sunnhemp	...	...	9,53·25	1,427·5

Range C.—Ragi versus ragi with akkadi, avare and jola. Cattle manure applied at 10,000 lbs. per acre. Variety H. 22.

			lbs.	lbs.
Ragi pure	...	...	818	1,330
Ragi with avare and jola	...	...	665	1,580

Range D.—Cultivation experiments. Variety H. 22. No manure, previous crop being togari.

			lbs.	lbs.
Intercultivated with kunte	...	...	1,489	2,440
Intercultivated with country plough		...	1,434	2,240

Range E.—Seed selection experiments. Variety Hullubele from the village.

			lbs.	lbs.
Sieve selected	...	...	1,530	1,780
Salt water selection	...	...	1.650	1,460
Check non-selected	...	...	1,450	1,700

Range F.—Different methods of sowing. Cattle manure at 10,000 lbs. an acre. Variety H. 22.

			lbs.	lbs.
Broadcast	...	...	1,304·1	2,340
Hak	...	...	1,429·5	2,255
Drill	...	...	1,316	2,176
Transplantation	...	...	1,397·5	2,163

Range H.—Bulk trial of H. 22. Sown with clipper drill 1″ apart 1,121 lbs. 2,022 lbs. Ragi varietal tests.

			lbs.	lbs.
H. 2	...	...	1,410	6,606·6
H. 22	...	...	1,122	1,546
H. 13	...	...	1,855	2,023·3
H. 32	...	...	1,740	2,320
H. 39	...	...	1,653	1,673
H. 40	...	...	1,773	1,806
Local Hullubele	...	...	1,395	1,690

Range J.

			lbs.	lbs.
H. 33	...	..	2,081	3,392
H. 43	...	...	2,091	3,513
H. 44	...	...	2,023	2,937
Local Hullubele	...	...	1,923·3	3,236

Range K.

			lbs.	lbs.
Local Hullubele	...	...	1,415	1,560
H. 2	...	...	710	1,360
H. 3	...	...	1,000	1,340
H. 22	...	...	1,340	1,420

Range K.—Trial of artificial manures on H. 22. Cattle manure 1,0000 lbs.

		lbs.	lbs.
Check	..	1,660	2,680
Castor cake 625 lbs. an acre	..	2,580	3,880
Am2So 4 at 125 lbs. an acre	..	2,580	3,520
Check cattle manure alone	..	892	1,864
Am2So 4 120 lbs. an acre	..	1,224	1,920
Am2So 4 120 lbs. an acre plus Super 240 lbs. an acre	..	1,328	2,400
Am2So 4 plus super as above plus K2So4 and 80 lbs. an acre	..	1-160	2,160

Bulk trial of groundnut (Virginia) in A range 1,602 lbs. an acre.

Range C. Groundnut Varieties.

				lbs. an acre
Transvaal	..	..	..	3,02'85
Mauritius	..	..	..	48'72
Range F. Sogatur	..	..	..	744
Range G. Virginia	..	..	..	500
Mauritius	..	..	..	660
Sogatur	..	..	..	73'34
Transvaal	..	..	..	740

Range B—Dry land togari varieties, cattle manure at 10,000 lbs an acre.

				lbs. an acre.
Islampur	..	..	..	1,200
Hassan	..	..	..	2,100
Kadur	..	..	..	2.580
Red	..	..	..	840
White	..	..	..	2,280
Tumkur	..	..	..	1,560

Range J. mixed crop of Castor and Avare.

				lbs. an acre.	
H 4	..	..	..	304	
H 5 castor	..	..	..	312	78 lbs. avare
H 7 castor	..	..	..	328	

Cotton Yield.

				lbs. an acre.
Cambodia	..	..	..	217
Columbia	..	..	..	312
Trice	..	..	..	303
Lonestar	..	..	..	253
Duramgo	..	..	..	398

The bit of land adjoining the well in the dry area has been levelled and brought under cultivation and the amount realized from sales of gourds, radish beans and other vegetables in the rainy season is about Rs. 76.

Report of the Deputy Director of Agriculture (Eastern Division) for the year 1922-23.

1. During the year under report, I held charge of the following :—

(*a*) The District work of the Eastern Division.
(*b*) The Nagenhalli Sugar-cane farm.
(*c*) The Sri Krishnarajendra Vyavasaya Dharma Patasala, Chikkanhalli.

2. *Staff.*—Towards the close of the year one more Agricultural Inspector was sanctioned for the Division. An additional Range is proposed to be created in the Mysore District, comprising the taluks of French Rocks, Krishnarajpet and Srirangapatam with headquarters at French Rocks and the new Agricultural Inspector to be posted for work in this Range. The total number of ranges is now 13, each of which is in charge of an Agricultural Inspector. The Agricultural Implement Depot and Inspector's office at Nanjangud was transferred to Chamarajnagar during the year under report. The Ranges are distributed as under :—

Bangalore District	... 3
Kolar District	... 3
Tumkur District	... 3
Mysore District	... 4

The number of Fieldmen in the Division remained unchanged.

3. *Leave, transfers, etc.*

Leave statement is hereto attached, Statement 'A'.

(1) Transfers—Mr. K. A. Krishnan, Agricultural Inspector was, transferred to the Nagenhalli Farm from the Chitaldrug District.

(2) Mr. C. V. Krishna Rao, Agricultural Inspector, was transferred to the Nagenhalli Farm from the Hebbal Farm.

(3) Mr. K. V. Ramaswami, Agricultural Inspector, was transferred to the Western Division from the Nagenhalli Farm.

(4) Mr. D. Venkataramanaiya, Agricultural Inspector, was transferred to the Western Division from the Nagenhalli Farm.

(5) Mr. A. K. Narayana Murthi, Agricultural Inspector, was transferred to the Chamrajnagar Range from the Western Division.

(6) Mr. M. S. Ramachandra Rao, Agricultural Inspector, was transferred to the Implement Depot from the Nanjangud Range.

4. *Tours.*—I was out in camp for 165 days in the year.

The number of days spent on tour by the different Agricultural Inspectors is given below :—

Agricultural Inspector,	Bangalore...	...	120 days.
Do	Channapatna	...	191 „
Do	Dodballapur	...	183 „
Do	Kolar	...	241 „
Do	Chikballapur	...	174 „
Do	Chintamani	...	196 „
Do	Tumkur	...	205 „
Do	Tiptur	...	106 „
Do	Maddagiri	...	144 „
Do	Mysore	...	198 „
Do	Maddur	...	208 „
Do	Chamrajnagar	...	170 „
Do	Yedatore	...	165 „

5. The clerical work in my office and also in the ranges has considerably increased. The following statement shows the number of letters received and the number sent out :—

	Letters.	
	Received	Sent out
Deputy Director's Office	7,075	4,905
Bangalore Range	946	1,137
Channapatna Range...	914	1,066
Dodballapur Range	535	691

	Letters Received	Sent out
Kolar Range	874	1,343
Chikballapur Range	1,224	1,251
Chintamani Range	439	637
Tumkur Range	1,256	1,345
Tiptur Range	826	706
Maddagiri Range	677	815
Mysore Range	1,400	1,540
Maddur Range ... —	1,148	1,559
Chamrajnagar Range...	942	1,258
Yedatore Range	660	743

6. *Library.*—Twenty-one books were added to the Library during the year under report. The total number of books in the Library is 97.

7. *Season.*—The early rains of the season were favourable throughout the four districts, and the sowings of the early mungar crops like jola, gingelli and kar ragi in the Mysore District were timely. These rains also rendered possible the timely preparation of the ground for hain crops like ragi, castor, groundnuts, etc., in this and in the other three districts. Later rains however were somewhat meagre which affected the kar crops somewhat adversely, but the yield of these was on the whole from normal to above normal.

8. Hain crops sowings were however somewhat delayed, but except in the taluks of Gubbi, Tiptur, Chikkanayakanhalli, Sira and Maddagiri and the eastern taluks of the Kolar District, the delay was not serious. In the above mentioned taluks, however, ragi sowings were either very late or could not be done at all. Rains were also disappointing after the main crops were sown, causing much anxiety. Towards the end of the mungar season in all the districts excepting the taluks mentioned above, conditions improved and the yield of the hain crops were good and even above average.

9. In most parts of the Kolar District, notably in Goribidnur and Mulbagal, and the taluks named above of the Tumkur District, the hain crop season was very poor and the ragi crop came practically to nothing, sown fields had to be ploughed up, minor grain crops like save or bargu being sown where there was some moisture. Elsewhere no sowings could be attempted in the hain season at all. This holding off of the rain caused great anxiety, as the tanks received no water, and the fodder question became acute. In these taluks date groves and avenue trees began to be denuded of their leaves for fodder and there was also migration of raiyats and their cattle to the neighbourhood of the reservoirs at Marikanave, Borankanave and Mavatur. In order to meet this situation measures to secure both fodder and grain, by making use of the scanty supplies of water in the tanks, the moisture in the tank beds for cultivation of quick growing crops, and by the utilisation of forest grass had to be taken, with the results detailed fully in para 54 of this report.

10. With rainfall of this nature wet crops under tanks were out of the question, and in all the districts there was either no Karthik paddy at all or only a very poor crop. Sugar-cane also greatly suffered, the yields being materially reduced by this condition. Under channel areas the paddy crops were of course normal. Even in this area, there was a breakdown at Bannur, which practically ruined the sugar-cane crop of that important cane tract. The rains of the hingar were however abundant and favourable, and though too late for the dry crops, saved hte situation as far as the supplies of water to the tanks was concerned. Many of the tanks received the full supply and even overflowed. Vaisak paddy was grown practically under all the tanks and with the few exceptions where the whole achakuts were sown regardless of the capacity of the tanks, excellent crops of paddy were raised.

The full supply of water also saved mostly sugar-cane crops which, prior to the rains, were kept alive at great cost by irrigation from temporary wells. The planting of new cane for the current cane season was also greatly facilitated and were it not for the unexpected low market for jaggory, a much larger area of sugar-cane would have been planted than was actually done.

11. Prices in fact of all kinds of produce have ruled very much easier, having come down in many cases by about 20 to 30 per cent. In the case of the food grains, ragi and jola, however, the reduction has not been so marked.

District Work.

12. The work of the District staff has, as heretofore, related to the inspection of estates for advice and assistance in the improvement thereof, to the popularisation of the various recommendations of the department, work in conjunction with co-operative societies, the maintenance of the sale depots, assistance to the other sections of the department in matters relating to insect pests and crop diseases, veterinary assistance and livestock improvement and sericulture. The various items are dealt with in detail in the following paragraphs.

13. *Inspection of Estates.*—The estates referred to here are in the nature of large properties situated in compact blocks, with the owners living in them and trying to work them to the best advantage. Such estates are often visited by the staff at the request of the owners and the number of estates so visited may be taken as a rough measure of the extent to which the assistance and advice of the department is appreciated. There is an increasing tendency on the part of landed proprietors to take an active part in working their land instead of continuing to be absentee landlords interested only in the rent ; the advice of the department is therefore being sought in an increasing degree every year. Many of these estates have been inspected more than once during the year ; and the advice sought has related to practically every form of improvement, installation of waterlifts, drainage, use of tractor drawn implements, cropping methods and so on. The estates include properties belonging to some of the largest landed proprietors in the State

14. The number of estates so visited is classified according to the Ranges below :—

Range	Number	Total No. of visits paid
Bangalore	20	64
Dodballapur	81	189
Channapatna	24	98
Kolar	12	57
Chintamani	9	...
Chikballapur	14	81
Tumkur	7	12
Maddagiri	23	45
Tiptur	6	22
Mysore	7	15
Maddur	3	4
Chamrajnagar	19	51
Yedatore	3	25

Demonstration and Sale of Implements.

15. *Improved Ploughs.*—As in former years a large number of demonstrations of all the types of improved ploughs were held. In a large number of villages visited in the ploughing season, the correct method of using these ploughs was shown. Ploughs with clients were also inspected and drawbacks in ploughing as disclosed by improper or undue wear were pointed out and the correct method explained. The demonstrations of all kinds of ploughs were as shown below :—

Range	Number
Bangalore	3
Dodballapur	10
Channapatna	90
Kolar	56
Chintamani	15
Chikballapur	40
Tumkur	41
Maddagiri	14
Tiptur	37
Mysore	40
Maddur	35
Chamrajnagar	71
Yedatore	54

16. The sale of ploughs has been more satisfactory than last year. A good stock of K. M. Ploughs was available, and they were sold readily, mainly in the Bangalore Depot. There has been an appreciable increase in the sale of the smaller ploughs also, like the Eureka and the Meston ploughs. These latter are being more and more appreciated in the paddy areas and it is worthy of record that one estate

owner, though a very old and conservative gentleman, recently increased the number of Eureka ploughs in use to five, being thoroughly convinced of their value and feeling that the few he had with him for some years were not enough.

17. There has been a serious shortage in the available supply of K. M. Shares, and complaints were received from nearly every depot.

18. Arrangements were made for manufacturing them locally but the delivery was not prompt, nor the quality first rate. It will be necessary to carry a big stock in the Central Depot even though they may not all be sold in the same season.

19. There has also been considerable increase in the number of six shovel cultivators sold; as quite a large number of these have now been in use for some years, there has been a demand for spare teeth for these cultivators which has been promptly supplied.

20. The total number of ploughs, cultivators and spare parts sold in the different ranges is given below:—

Range	K. M. Ploughs	Meston	Eureka	Verity	Six shovel cultivator	Shares and other spare parts
Bangalore	271	7	..	..	4	268
Dodballapur	..	..	..	..	..	3
Channapatna	4	1	22	..	9	66
Kolar	15	1	..	..	4	53
Chintamani	5	4	..	..	1	16
Chikballapur	4	8	..	1	6	115
Tumkur	7	3	6	1	3	106
Maddagiri	3	..	2	..	3	2
Tiptur	6	1	8	1	7	97
Mysore	9	2	11	..	13	129
Maddur	10	..	8	..	8	70
Chamrajnagar	8	..	2	..	..	85
Yedatore	8	12	13	..	8	54

21. *Hiring out of implements.* The ploughs and cultivators kept for hire in the different depots were also fully made use of in the season. Ploughs and cultivators were also hired out by more than one co-operative society; there are now several societies which keep a set of these for hiring out to members; the societies at Tyamagondlu, (Bangalore District), Nonavinkere, Turuvekere, Mayasandra (Tumkur District), are the more important ones and they have been carrying on this work for a long time now. Other societies are also coming into the scheme; a fuller account of these will be found under para 60.

22. *The disc harrow* supplied to some of the depots for demonstration has also been made use of by ryots; it has been used mainly for the preparation of land for sugarcane subsequent to ploughing; to a certain extent it has been used on other lands preparatory to ploughing. The purpose for which the harrow has been used and the number of days it was in use are given in the following table:—

Range	No. of days in use	Purpose
Bangalore	2	Discing sugarcane field.
Channapatna	33	Breaking of clods and making ploughing easy.
Kolar	9	Breaking of clods.
Tumkur	2	Breaking of clods and making ploughing easy.
Tiptur	4	Ploughing in cocoanut gardens.
Chamrajnagar	1	Breaking clods, etc.

23. This is an implement well suited for co-operative use and now that several co-operative societies have consented to have an agricultural section, so to speak, it will be possible to induce some of them to own one of these useful though costly implements.

24. *Seed drills.*—Though it may be conceded that the seed drill is a common implement in this Division, nevertheless in many taluks, it is not used at all and in others the type of drill used is capable of improvement with no additional cost; even in areas where the drill is well known, it is beginning to be discarded in favour of the quicker and less troublesome practice of broadcasting. As drill sowing is a better practice and generally conduces to a better yield an attempt has been made to popularise its use, and at the same time to introduce a better type. The type selected is the one also in use in many parts of the State with solid teeth or tines, in which therefore there is no risk of blank rows resulting from choked tines or teeth which occur in the type with hollow teeth. This drill was demonstrated in the places mentioned below:—

Range.	Number of villages.
Bangalore	In general use
Channapatna	15 and also in general use
Dodballapur	In general use
Kolar	do
Chintamani	do
Chikballapur	do
Tumkur	2
Maddagiri	In general use
Tiptur	do
Mysore	2
Maddur	1
Chamrajnagar	1
Yedatore	...

25. If these can be made available in large numbers and also cheap, they will come into use in many villages.

26. *The New Hebbal Plough.*—Further tests were made of this model both on the estates of clients and on the Nagenhalli Farm. In the latter place, the life of the share was only 4 29/40 acres; in its actual working it was found to be even better than the K. M. Plough, ploughing a larger furrow and being steadier and better balanced. As the model, now named Mysore Plough, had by now received the approval of the department as well as of many important cultivators, it was to have been manufactured and got out from England in time for the current season. As the consignment arrived somewhat late, after the close of the official year, no trials could be reported as part of the work of the year under report. Some of these have however been sold and the report of work will be available only for the next official year.

27. *Tractor Ploughs.*—As in the previous year, several applications were received for the hiring out of the departmental tractor and the ploughs and disc harrows forming part of the outfit, but not even one of these applications could be complied with. One applicant requested that at least a driver with experience in working on Oliver Plough and Austin Tractor might be sent to work an outfit he had secured. Even this could not be complied with. The purpose for which the outfit was applied for, was for a light ploughing such as is done by a country plough on ragi land, but quick enough to cover a large area of about 100 acres in the main season, so that horsegram could be sown as a preparatory crop to ragi in the following season. This was in two cases. In three other cases it was for ploughing heavy black cotton soil.

28. The outfit in Mr. Mac Isaac's estate referred to last year, consisting of a Fordson tractor, with ploughs and disc harrow, etc., was in use quite satisfactorily throughout the year.

29. *Stone threshing rollers.*—As might be seen from my previous reports, these rollers which are very common and have come into use rapidly throughout the Bangalore, Tumkur and Kolar Districts, have been either not taken up at all in the Mysore District or been very slow indeed, although the roller is used most commonly elsewhere for the threshing of jola and Mysore is the district in this Division which may be called a jola growing district. A persistent attempt has been made by the district staff to introduce these in that district both by demonstration and persuasion. Our efforts have at last succeeded, and I have to report a considerable sale of these in the year under report. We have now created a demand, and in addition to supplying it direct from the Department itself, we

have been able to place raiyats requiring rollers in touch with stone wodder maistries able to supply them. The number sold in this district is given below :—

Range.	Number.	Range.	Number.
Mysore	.. 9	Chamrajnagar	.. 20
Maddur	... 69	Yedatore	.. 2

It is noteworthy that in far off Periyapatna, two such rollers were sold in the year.

30. The rollers with the Agricultural Inspectors were also demonstrated in a number of villages as shown below :—

Range	No. of villages where demonstrated	Demonstration of ragi or jola threshed
Channapatna	14	Ragi threshing.
Mysore	7	Ragi and jola threshing.
Maddur	5	Ragi threshing.
Yedatore	3	Do

31. In addition to the rollers sold as noted above, Agricultural Inspectors have also helped to obtain rollers for raiyats in many of the ranges notably in Channapatna where 20 were thus supplied.

32. *Nahan Sugarcane Mills.*—The popularity of the Nahan Mill is increasing year by year; unfortunately owing to some reason or other an adequate supply of these mills could not be got out in time. A great deal of disappointment has been caused during the year, as the mills arrived very late in the season and even then only a very small number too few to meet the demand. Thirty mills were sold in the Division as shown in the table below :—

Range.	Number.	Range.	Number.
Bangalore	... 2	Mysore	... 1
Channapatna	... 1	Maddur	... 7
Chikballapur	... 18	Chamrajnagar	... 1

The mills were all sold out for cash within a few days after their arrival. In and about Goribidnur and Dodballapur the mill is so popular that ryots gladly pay as hire twice the amount ordinarily charged on the other types.

In view of the larger number already in use, it will be advisable to have a good supply of spare parts, readily available.

33. *Trial of C. I. W. Mills.*—It is obvious that if the Nahan type of mill can be copied locally and become available at a reasonable price, the scope for a profitable business advantageous to Government and raiyat alike is very great. The Central Workshop has been attempting to manufacture mills of this type, and in cooperation with this department to introduce it into use. One such mill was set up for trial in a milling house in the Goribidnur taluk but owing to certain minor defects did not give satisfaction. These defects have, it is understood, been rectified and in the coming season the mills will be subjected to further trials.

34. The demonstration Nahan mills with the different depots were demonstrated as per particulars below :—

Range	No. of villages where demonstrations held and days	
	Villages	Days
Bangalore	5	44
Dodballapur	5	9
Channapatna	5	63
Kolar	4	22
Chintamani	2	60
Chikballapur	3	33
Tumkur	10	78
Maddagiri	...	...
Tiptur	4	60
Mysore	1	40
Yedatore	3	33

The mills were also lent out on hire for various periods in almost every range. The number of days they were out on hire in the different ranges is given below:—

Range.	No. of days hired out.
Bangalore	28
Channapatna	7
Kolar	24
Chikballapur	33
Tumkur	66
Tiptur	60
Mysore	40

35. *Jaggory Boiling Demonstrations.*—As in former years much time has been devoted by the staff in connection with jaggory making demonstrations and work connected therewith. In most cases, the Nahan Mills purchased newly have been set up for the purchasers by the District Staff; old Nahan Mills have been inspected at milling time and wherever faults were noticed in working the same have been remedied; improvements in the furnaces have been introduced such as the provision of fire bars and of chimneys; likewise the use of litmus paper for judging liming and of the use of gauze strainers for skimming the juice have been introduced; in certain places double pan furnaces were also constructed for the raiyats. The number of jaggory boiling houses attended to in this manner is shown below:—

Range.	No. of houses.
Bangalore	4
Dodballapur	9
Channapatna	4
Kolar	24
Chintamani	1
Chikballapur	30
Tumkur	11
Maddagiri	3
Tiptur	4
Mysore	7
Chamrajnagar	2
Yedatore	2

36. As a general result, the quality of jaggory has been improved, good jaggory made where only a soft and sticky material was being turned out and considerable saving effected in the fuel consumption.

The jaggory boiling furnaces at the Nagenhalli Farm and at the Sri Krishnarajendra Vyavasaya Dharma Patasala, (formerly the Chikkanahalli Agricultural School) were also visited by raiyats during the milling season, to observe and copy these furnaces in their own villages.

37. *Small scale power mill.*—The small power mill belonging to the Department was used on the Nagenhalli Farm as in the previous year and attracted much notice. The raiyats of Nagenhalli village who had grown sugarcane round the Farm were anxious to use the mill and the Farm jaggory boiling appliances on hire and they were permitted to do so at a hire of Rs. 3 per day. There is considerable scope for a small portable outfit of this kind.

38. *Sugarcane mills owned by co-operative societies.*—Sugarcane mills are now owned by 7 co-operative societies in this Division, (as shown below) which are used by the members and are also hired out to others.

Range.	Name of co-operative society.
Bangalore	Bokkasagar and Ramohalli.
Kolar	Nernahalli, Sugatur, Sundarapalya and Devarayasamudra
Chikballapur	Gadare.

In addition to the two co-operative cane milling societies of the last year, two more have been formed, namely, Devarayasamudram and Sundrapalya (both in Kolar). As the work of agricultural co-operation has however greatly developed in the year a detailed account is given under agricultural co-operative societies) *Vide* para 59).

39. *Seed Selection.*—The practice of selecting seed from good earheads in the field before harvest and later by the use of salt water in the case of paddy and ragi has been largely explained and has come into adoption in many villages. The desire to keep the now extensively grown—22 ragi purely for seed purposes has acted as an additional incentive in the case of selecting good earheads of ragi. Reports of a better stand of crops in all such places and of increased yield in many, have

beenareceived from all the ranges. A great deal of work has been done under this head in the year under report. The quantity of seed selected by the departmental staff alone is given in the following table.

Range.	Name of seed selected.	Quantity.
Channapatna	Ragi and Paddy	1,650 seers.
Kolar	Paddy	
Chintamani	Ragi	320 ,,
Chikballapur	Ragi	3,140 ,,
Tumkur	Ragi and Paddy	575 ,,
Maddagiri	Ragi	5,200 ,,
Tiptur	Ragi and Paddy	12,900 ,,
Mysore	Ragi	200 ,,
Chamrajnagar	Ragi and Paddy	120 ,,
Yedatore	do	700 ,,

40. *Ploughing after Harvest.*—This practice though much appreciated is on account of the difficulty of the operation if it is not done immediately after harvest, and of the pressure of work, is slow to be taken up. There was however a striking response to our repeated preachings in this regard which came to my notice, where immediately after the harvest of horsegram, late in the season, even though the ground was too hard to plough, the three bladed dodkunte of the Bangalore District had been used to loosen the surface soil, as the next best to a ploughing. Work has been done however in all the ranges in inducing raiyats to adopt the practice in spite of its difficulty, and in Tumkur and Bangalore, the disc harrow was lent out for this purpose.

41. *Wider planting of sugarcane.*—The advantages of planting sugarcane wider than in 1½ to 2 feet rows now common in the Bangalore and Kolar Districts have been explained and in many villages in both these Districts, raiyats have, in the year under report, put down small areas in wider rows, though not without scepticism as to its merits. Especially have the new varieties of sugarcane (*vide* para 50) sent out, namely, the H. M. 544 and 312 and other seedling canes, all been planted in this way. In and about Sabbanhalli and the whole cane area of Mr. Lakshmana Reddi and his tenants has been put out in wider rows. The total area in all the ranges, which is made up of a large number of small plots is about 88 acres; the largest being in the Kolar District.

42. *Deeper planting.*—In order to minimise the tendency to lodge of the new varieties especially and of local varieties on rich soils, the practice of deeper planting has been advocated. Mr. Gouse Peer in Bannur carried out this recommendation on his cane fields of H. M. 544. Mr. T. Subba Rao of Tippur planted all his own canes over about 3 acres in trenches about 1½ feet deep, as his soils are exceedingly rich, favouring a most luxuriant growth of cane.

43. *Economic transplanting of paddy.*—This is one of the practices in which special endeavours were being made in the nala tracts and in all important paddy growing sections. The stationing of special fieldmen at French Rocks, Bannur and Maddur, and of the depot at Yedatore has resulted in a great extension of the practice. In Maddur, in and around Darsaguppe near French Rocks, and round Mallur near Channapatna, the practice may be said to have become general. The practice in the *nala* tracts of Mysore where transplantation is done by contract labour militates against rapid progress. but the repeated endeavours of the staff has certainly led to a material reduction of the seed rate in all these areas. The areas of economic transplantation done through and otherwise inspected by the staff are as noted below:—

Bangalore Range	...	5 acres
Dodballapur	...	nil
Channapatna	...	160 acres
Kolar	...	10 ,,
Chintamani	...	6 ,,
Chikballapur	...	21 ,,
Tumkur	...	2 ,,
Maddagiri	...	nil
Tiptur	...	32 acres
Mysore	...	136 ,,
Maddur	...	50 ,,
Chamrajnagar		Round about Alambur and 10 acres at Agara.
Yedatore	22	acres.
Total	454	acres.

Demonstration plots to convince the raiyats of increased yields in addition to the saving of seed were also laid out on small areas aggregating to about 16 acres in the whole Division. Improvements in cropping methods and implements are very slow to be taken up, compared with new varieties or manures, but this particular one is likely to prove an exception and I have hopes that it will spread rapidly.

MANURES.

44. *Cattle manure.*—Recommendations in regard to improving the quality of cattle manure by the construction of better cattle stalls and manure pits are slow to be heeded and little progress has to be reported in this year also. Only four individuals are reported to have improved their cattle stalls in accordance with our recommendations, two of them in Chikballapur Range and the other two in the Nanjangud Range.

45. *Green manure.*—The demand for green manure crop seeds has now greatly increased and the Division has found it difficult to meet the demand adequately. Seeds are in demand not only for being sown in paddy fields, but in cocoanut and arecanut gardens, and for even garden crops like potatoes.

In the channel area of Yedatore and Mysore where the attempt to grow green manure crops is rather precarious, and in the Nanjangud taluk under the Hulhalli *nala* irrigation, the bulk of the raiyats have been so far induced as to gladly offer to pay any small charge for the supply of channel water for the raising of green manure. There was however a serious shortage of water in the rivers, owing to the somewhat late breaking out of the monsoon and it is reported the grant of the raiyats' prayer could not be thought of.

Under many of the large tanks in this Division where enough water is not received for a Karthik crop of paddy, sunnhemp could be sown with great advantage to be used either for green manure or as fodder, according as paddy is proposed to be grown or not in the Vaisak, and I have been endeavouring to bring this about, with not such success so far; but the scope for usefully adopting this practice is great.

The quantity of seed actually sold by the different depots is given below:—

Range	Quantity in seers.
Bangalore	291
Dodballapur	200
Channapatna	142
Kolar	6
Chikballapur	294
Tumkur	74
Tiptur	609
Mysore	270
Maddur	1,043
Chamrajnagar	250
Yedatore	270
Total ...	3,457

46. *Oil Cake.*—As explained in the previous reports, this Division has ceased to purchase and stock oilcake as such, but has been helping raiyats to purchase direct from suppliers. The work of these years has been fruitful in as much as in places where the use of oilcake was unheard of it has become quite common now, as a manure for sugarcane. In Bannur and Seringapatam alone 720 maunds of groundnut oilcake was purchased through the department by cane growers; at Malvalli 700 maunds were supplied; at Yedatore 60 maunds were supplied; and these are all places where the practice was unknown. In Maddagiri and Kolar practically the whole production of the local *ganas* amounting to about 90 tons has been bought by the raiyats of the taluks themselves for manuring not only sugarcane but also paddy fields.

Unfortunately for cane growers, the price of jaggery in the year under report became very low and many of them have incurred heavy loss; the price of oilcake did not come down materially. This circumstance is bound to affect prejudicially any large purchase of oilcake by local growers for application to the standing crop of cane.

47. *Artificial Manures.*—(*a*) Sulphate of Ammonia.

The growing popularity of ammonium sulphate as a manure for sugarcane is a gratifying feature of the year's work. The most notable use has been in the Dodballapur Range, where in the former year, the manure was supplied as an experiment to about half-a-dozen sugarcane growers. The results were so striking and so much appreciated by raiyats that in the year under report the quantity supplied from that one depot rose to 10 tons of the value of Rs. 3,200. In addition to this quantity supplied by the depot, raiyats have independently ordered and purchased from supplying firm 72 maunds of the manure. There was considerable delay in the supply of the manure from one of the Bombay firms, and the Department too was so to speak feeling its way in this matter, and ordered only in lots of a few tons at a time, lest stock should accumulate unsold. Otherwise at least half as much more could have been easily sold. It is proposed in the coming year to interest the local co-operative societies or even a special association of raiyats in financing this supply.

Another feature also worthy of record is that this large quantity was supplied not to a few large land holders in fairly large quantity but was taken by 186 raiyats and in 45 villages.

The Bangalore Range also sold a large quantity, namely, 8¼ tons, but this has been mostly in comparatively larger lots and to fewer raiyats.

The total quantity sold in the Division is more than 24½ tons as shown below:—

Range.	Quantity.
Bangalore	8 tons and 21 mds.
Dodballapur	9 tons and 68 mds.
Channapatna	2 tons and 11 mds.
Kolar	67 maunds.
Chintamani	14 maunds.
Chikballapur	1 ton and 39 mds.
Tumkur	10 maunds.
Tiptur	4 maunds.
Mysore	77 maunds.
Chamrajnagar	32 maunds.
Yedatore	10 maunds.

In order to popularize the manure further, prizes for standing crop competition of H 22 ragi, awarded by the District Boards of Kolar, Bangalore and Tumkur, were given in the form of small bags of sulphate of ammonia. The number of raiyats to whom the manure was thus issued is 211 (*Vide* also under H 22 ragi para 52).

The high cost of groundnut oilcake powder which at one time sold at about Rs. 120 to Rs. 130 a ton made the sulphate of ammonia really cheaper as a source of nitrogen, and it has accordingly been used also to some extent in the special mixture for other crops being recommended and sold (*Vide* below).

48. *Bonemeal, superphosphate, and special mixture for paddy.*—The use of the special manure mixture for paddy has been somewhat slow in being taken up. The high cost of supers and bonemeal coupled with the somewhat easier price of paddy, has acted as at least one cause. There has however been no slackening in our efforts; demonstrations are arranged in a number of places and the results brought to the notice of the villagers. There has been no doubt about higher yields by the use of the manure but the high cost of the manure this year has considerably neutralized the advantage of the high yields. The manure was issued altogether in 83 villages to 107 raiyats, and the total quantity sold was about 10 tons as shown below:—

Bangalore	15 maunds.
Dodballapur	50 „
Channapatna	16 „
Kolar	48 „
Chintamani	160 „
Tumkur	4 „
Tiptur	391 „
Mysore	53 „
Yedatore	77 „

Results received indicate increased yields upto 9 pallas per acre or 40 per cent. Under the Hoskote tank also where a number of plots were manured with the mixture, the standing crop was very striking, but the yields however cannot be reported

as the harvest has not begun. A certain amount of superphosphate was also issued for use along with ammonium sulphate for sugarcane in the Bangalore Range.

49. There is no doubt considerable interest has been aroused in artificial manures and inquiries are frequent for manures for all kinds of crops including dry crops like ragi. This line of work is likely to develop materially in the coming year. The demand has been met to a certain extent and with some amount of caution.

The quantity of the special mixture sold is as noted below:—

Range.	Potatoes.	Quantity of manure issued for Cocoanut.
Bangalore	1,255 lbs.	... ...
Tiptur	...	... 550 lbs. ...

50. *Crops—Sugarcane.*—Work in connection with the introduction of the new varieties alone is reported in this section. Wider planting, manures, milling, etc., have been already separately reported.

The new seedling canes distributed in the last year everywhere made excellent growth and in great contrast with the ordinary pattapatti. The yield of jaggery also was equally high and of good quality. The growth of the cane was surprisingly fine in Mr. Chikke Gowda's fields at Sravandahalli; Mr. Subba Rao's at Tippur, Yedatore Taluk; at Ardeshahalli near Dodballapur; on Mr. Lakshmana Reddi's at Sabbanhalli; at Kattegenhalli near Chintamani; at Palhalli near Seringapatam; at Kannidoddi near Channapatna and several other places too numerous to be particularised. Mr. Lakshman Reddi of Sabbanhalli and Mr. Krishnaiengar of Ooragahalli had grown the variety over large areas. The tonnage of the cane has been in the best of cases 60 tons per acre, while the jaggory yields ranged from 150 maunds to 614 maunds per acre. Practically in every place where it was tried, the jaggory yield has been higher than the pattapatti cane. On Mr. Krishnaiengar's estate at Ooragahalli however, the pattaptti has done better than the H. M. 544, probably owing to the fact that on his excellent soil and high class cultivation, the pattapatti which is a better tillering cane than the H. M. 544 scored on account of this particular character.

The H. M. 312 with its extraordinary vigour of growth has been somewhat of an embarassment as its height and liability to lodge have been too great a difficulty for the raiyats. Results of comparative trials of the different varieties have been reported by many of our growers and are given below:—

		Variety	Yield per acre
Channapatna Taluk	...	H. M. 544 ...	420 Maunds jaggory
Closepet	,, ...	H. M. 312 ...	400 ,,
Magadi	,, ...	H. M. 312 ...	320 ,,
Devanhalli	,, ...	H. M. 544 ...	400 ,,
Maddagiri	,, ...	H. M. 312 ...	365 ,,
Kolar	,, ...	J. 33a ...	210 ,,
Chintamani	,, ...	Red Mauritius ...	260 ,,

The result of the last year's trials has been a great demand for the variety H. M. 544. In making the distribution the principle of starting nucleus seed centres in as many places as possible has been followed. The seed supply for the current year has been largely from the Hebbal Farm, Nagenhalli Farm, Mr. Mac Isaac's estate at Gangenhalli, Mr. Oorgahalli Krishniengar's estate, Mr. Chikke Gowda's estate at Sravandhalli, Mr. Gouse Peer's estate at Bannur. The following statement gives the rangewar distribution:—

Range	No. of setts
Bangalore	32,000
Dodballapur	52,000
Channapatna	57,949
Kolar	40,000
Chintamani	29,000
Chikballapur	67,664
Tumkur	21,566
Maddagiri	17,600
Mysore	54,000
Chamrajnagar	84,000
Yedatore	52 500

A total of 508,279 setts has been distributed, which would plant about 60 acres. The distribution has been over a wide area, and it is expected that with so many seed centres, the trouble and expense incidental to getting cane setts from far off places like Hebbal or Nagenhalli or other villages would be greatly reduced in the coming year.

It is pleasing to record here that Mr. N. Krishniengar of Ooragahalli distributed the whole of the seed setts of his H. M. 544 crop free of cost to his fellow cane growers, for which the thanks of the department are due to him.

J. 33a is another variety that has been distributed especially in the Mysore District. Quite a good supply of these setts was obtained from Mr. C. Venkata Rao who grew a good crop of this cane. The number of setts distributed was 17,000.

In addition to these, small lots of other promising varieties like H. M. 553, H. M. 320 have also been issued in the current season for trial.

The seed cane distribution this year was an arduous task, as the quantities were large and had to be sent to many different places, put in the hands of growers promptly and the planting also attended to without loss of time. All this was carried out by the district staff very satisfactorily, thanks of course to the ready response of the growers themselves.

The District Board of Kolar rendered financial assistance in this work by voting Rs. 50 to bear part of the railway freight on the canes distributed in that district.

51. *Paddy.*—As usual, the varieties of paddy distributed have been the early maturing varieties suited to areas where the water in the tank may not be sufficient for the long duration varieties. The short season varieties distributed were Hallubbalu, Banku, Kapile Sanna and Chintamani Sanna. The Banku paddy seed was all supplied from out of the produce of Nagenhalli Farm. The quantities distributed in the different ranges were as below:—

Range.	Total quantity
Bangalore	2,407 seers.
Dodballapur	96 ,,
Channapatna	271 ,,
Kolar	4,000 ,,
Chintamani	2,190 ,,
Chikballapur	7,956 ,,
Tumkur	1,912 ,,
Maddagiri	7,467 ,,
Tiptur	5,537 ,,
Mysore	3,582 ,,
Maddur	153 ,,
Yedatore	428 ,,
Total ..	35,999

As referred to in para 10, on account of a favourable north-east monsoon, the tanks in the eastern taluks of the State received abundant supplies of water; and as owing to failure of paddy crops in the year previous, no seed paddy was available in these tracts a large quantity of Hallubbalu paddy was got out and supplied in these localities. The paddy was new to the taluks of Kolar above mentioned, but it was a great success nevertheless and yielded at the rate of 8 to 16 pallas maturing within 4 months.

Banku paddy is becoming quite popular and is greatly liked in all the taluks on account of its fine superior rice. The quantity distributed was 36¾ pallas.

The long season variety, called Nagpur fine paddy, used to be supplied in small quantities in former years is gaining some popularity in the channel area of Mysore. In the year under report 35·82 pallas were supplied by the department alone. In addition to this a considerable portion of last year's produce has been reserved for seed both in the *nala* areas of the Mysore District. The quality of the rice is excellent, the yield is about the same as the local long duration varieties, and the paddy fetches about Rs. 3 more per candy than the local varieties.

52. *H. 22 Ragi.*—The area under this ragi has greatly increased in the year under report. A number of villages have taken to this variety newly in the year.

The variety is spreading of its own accord, the growers themselves distributing seed to a great extent. Nevertheless the department did not cease altogether to supply seed. The area which was sown and which came into the notice of the department was 22,576 acres; but there is no doubt the actual area is somewhere about 90,000 acres or about four times this acreage. The yields of the year have also been satisfactory, as compared with the varieties grown locally. The following statement gives the yield as reported for the ranges:—

Range	Yield per acre		Area over which data were collected
	H. 22 ragi	Local	
	Seers.	Seers.	
Bangalore	571·43	300·00	84 acres in 10 villages.
Dodballapur	401·25	216·37	50 „ 8 „
Channapatna	624·27	618·75	140 „ 11 „
Kolar	413·75	333·12	56 „ 8 „
Chintamani	600·62	500·88	6 „ 1 „
Chikballapur	594·86	440·14	228 „ 7 „
Tumkur	425·00	353·14	14,678 „ 7 „
Maddagiri	500·00	440·00	.. ..
Tiptur	455·00	315·90	67 „ 10 „
Mysore	550·00	300·00	31 „ 2 „
Maddur	750·00	650·00	31½ „ 3 „

Though the acreage on which the variety was sown is large, yet the scope for further expansion is immense, as this present acreage is but a fraction of the area under ragi in the Division. No efforts are being spared therefore to pursue demonstration work; plots for comparative trials still continue to be laid out; crop yields are taken and the advantages also largely explained.

H. 22. Ragi crop competition.—As in the previous two years, the system of awarding prizes at the annual district conferences for the best crops of H. 22 ragi raised has continued. The District Boards of Kolar, Bangalore and Tumkur kindly bore this year the entire cost of the prizes. Prizes this year were in the form of ammonium sulphate packets. Quantities ranging from 5 lbs. to 25 lbs. according to the class of the prizes were put up in neatly made bags and given away. The novelty of the scheme was an attractive feature of the conferences this year. The object was of course two-fold, namely, to recognise good growers of H. 22 ragi and to popularise at the same time the new manure, ammonium sulphate.

Seed Farms of H. 22 ragi.—As in the former years certain selected raiyats were supplied with pure H. 22 seed ragi from the Hebbal Farm, so that the seed for general distribution for the following year may be derived from these raiyats, thereby ensuring a steady and yearly supply of pure seed for the districts for general distribution.

Seed distribution through co-operative societies.—Fifty co-operative societies also took part in the supply of seeds as in the former years, the quantity supplied through them being 33,454 seers.

Other varieties of ragi.—Side by side with the extension in the area of the H. 22 ragi, tests of other strains of ragi raised on the Hebbal Farm and pronounced promising in comparison with H. 22 ragi were also arranged for. A large number of reliable clients undertook these trials in the different ranges, and the way in which the plots were laid out and the cultivation attended to was worthy of all praise. Many of these were inspected by the Director of Agriculture in his tours. Some of the new selections have done very well indeed, though compared with H. 22, the results are not uniform. One selection especially H. 44 has been much liked, and this has now been sown on an area of 3 acres. The results as far as received are given in Statement B.

53. *Groundnuts.*—In former years considerable quantities of groundnut of the short season erect foreign varieties Small Japan and Spanish Nuts used to be supplied in this Division. Except in certain parts of the Mysore District, these

varieties are not being taken up much. Though the area under groundnut cultivation is rapidly extending, the preference in the remaining districts is for the trailing main season variety called Badami or Seeme Kayi; the old local variety with its thin long pods and much fancied for eating purposes has all but gone out of cultivation. The quantity of seed supplied through the depots was 2,044 seers as under:—

Range	Quantity
Bangalore	83 seers.
Kolar	397 ,,
Chintamani	103 ,,
Chikballapur	307 ,,
Tiptur	176 ,,
Mysore	549 ,,
Maddur	400 ,,
Chamrajnagar	19 ,,
Yedatore	10 ,,

Other varieties of groundnuts.—Four select varieties from the Hebbal Farm were sent out to different clients for testing with the local varieties. These tests were arranged according to plans supplied and conducted with much care. Results were sent in by some of these growers and are given in Statement 'C'

As the yields of all these varieties can be largely increased by growing them as semi-irrigated crop, an attempt was made to introduce the cultivation of the short season Small Japan variety in the paddy fields in the channel areas, where a catch crop of pulses is generally raised prior to the paddy. One client to whom the seed was issued grew a very good crop which yielded at the rate of 2,500 lbs. or 25 pallas per acre. The practice is likely to be taken up.

54. *Jola.*—As part of the emergency seed supply referred to above, 113·20 pallas of jola were also supplied chiefly in the Maddagiri Taluk. The jola was recommended to be sown not only on the type of lands on which they are usually grown in the Hingar season, namely, on wet lands as semi-irrigated crop, on the black cotton soils as a dry crop and on tank beds, but also on the red soil dry lands, on which jola sowing at this season is not usual. The idea was that even if the moisture may not last for the crop to mature grain, such vegetative growth as may be possible would provide fodder at least, the shortage of which was in fact a more serious problem at the time than that of grain. The idea was explained in all these taluks but met with little response, so that the jola was all mostly sown on the usual type of soils. The area was in fact so large in the season that in Maddagiri Taluk at least it is considered a record one. The yields are reported to be about 5 to 8 pallas per acre on good soils; on the ordinary type of soils, the fodder was much appreciated, the grain itself being negligible.

Throughout these taluks the timely supply of seed paddy and jola by the department has been gratefully appreciated, the raiyats having learnt with a certain amount of agreeable surprise that there was a department looking after their interests to this intimate extent.

That the sowing of jola at this time of the year as an emergency measure is not altogether a mistake was however demonstrated on the Chikkanhalli Agricultural School lands, where late sown jola on the dry land soil made quite a normal growth and yielded grain at the rate of 8 pallas an acre.

55. *Sunflower.*—With the same object and at about the same time, some sunflower seed was supplied to be sown for fodder on the dry land. Both the crop and the idea itself were however exceedingly novel; not much was attempted. A few raiyats grew the crop as a curiosity; some however have collected seed for the next reason. A few also tested if cattle would relish the fodder, with results not uniformly favourable.

56. *Castor.*—One of the Hebbal selections of castor H.8 which did extraordinarily well on the estate of Mr. Mac Issac two successive seasons, was distributed in the districts to the extent of 450 seers of seed. It was tried by many clients all on a small scale of a few rows; yields of 2 pallas per acre in excess of their local varieties have been reported; the produce will all be used for seed and the extent under this selection will in the current season be appreciable.

57. *Potatoes.*—The new varieties "Up-to-date" and "British Queen" referred to in last year's report were issued in the year under report to a few clients. The quantity supplied was 41 maunds. The standing crops were pronounced very good; the yields will be available only for the next report. It has been arranged to purchase the greater part of the produce for seed supply.

The Co-operative Society of Chikaballapur which has voted Rs. 2,000 for agricultural work has expressed its desire to take up the supply of seed potatoes if the department were to assist in getting a guaranteed supply of seed whether from local or from foreign sources.

58. *Vegetable seeds.*—All the depots were supplied with small quantities of vegetable seeds; in addition, the various co-operative societies which have come into the new scheme of taking up agricultural work have also likewise been supplied. There is no doubt this is a popular line of work; the stock is usually sold out very soon after the supply is received. The total value of the seed supplied last year is Rs. 27.

59. *Work in conjunction with Co-operative Societies.*—In the year under report a new scheme was drawn up in consultation with the Registrar of Co-operative Societies in order to associate the present co-operative societies doing only banking business with the work of carrying on the sale of agricultural implements, seeds and manures as an adjunct to their banking business. The societies were to set apart a certain sum out of their reserve fund for financing this business; they were to be supplied with such articles as the Agricultural Department recommends, and at a concession rate; their retail cash price was to be the same as that charged by the department; the department was to help in the popularization and sale of these and also to take back such as might remain unsold for six months. The scheme has been explained to the Societies and the undermentioned societies have voted the sum mentioned against them for the work. They have all been also supplied with articles that could sell quickly in the neighbourhood (*Vide* Statement 'D').

In addition to these, as in the former years many of the credit societies have taken part in the sale of manures and seeds to the members as shown in Statement 'E'.

60. Some societies have been hiring out ploughs and cultivators, sugar-cane mills and pans purchased by them in the former years as noted below:—

Name	*Articles kept for hire*
Bangalore Range—	
Bukkasagara	Nahan sugarcane mills and ploughs.
Medihalli	
Jakkanhalli	
Tyamagondlu	
Chikbanawar	
Channapatna Range—	
Begar	Kolar Mission, Eureka and Meston ploughs
Chikballapur—	
Gadare	1 Mill and two pans.
Tumkur Range—	
Anenahalli	Two K. M. Ploughs.
Maddagiri Range—	
Midigesi	K. M. plough and cultivator.
Kodigenhalli	Do
Chendragiri	Do
Kolar Range—	
Mudiyanur	2 ploughs and 1 cultivator.
Mysore Range—	
Yelwal	Six shovel cultivator.
Yedatore Range—	
Periyapatna	K. M. plough, Eureka plough and K. M. cultivator.
Hunsur	K. M. plough and Eureka plough.
Tiptur Range—	
Mayasandra	Kolar Mission ploughs, cultivators, shares, Meston ploughs.
Thandaga	
Mavinakere	
Kanathur	
Nonavinkere	
Turuvekere	
Kodehalli	

These implements are being made use of to a great extent and the societies are doing very good work.

Special cane milling societies.—The special cane milling societies of Nernahalli and Sugatoor in the Kolar District continued to work satisfactorily; the former has paid up-to-date Rs. 270 out of hire received for the mill to the Central Bank, from which they had taken a loan of Rs. 400 for the purpose. The latter earned Rs. 120 as hire.

Two more societies were formed in the year one in Devarayasamudram and the other at Sundarapalya both in the Kolar District. These are in the nature of agricultural co-operative societies in general, with cane milling as an important item of the work. Articles to the value of Rs. 100 have been purchased by the first, and of the value of Rs. 400 by the second.

62. *Work in conjunction with the Scientific Sections, Sericultural, Veterinary and Live Stock Sections.*—The district staff has devoted considerable time to work in conjunction with all the above sections as noted below:—

(*a*) *Chemical Section.*—Specimens of soil from Maddur on which the growth of H.22 ragi was peculiar, soils which were used as manure at Malur, special manures being used for paddy and potatoes also from Malur were got and sent for analysis.

(*b*) *Entomological Section.*—Insect pests like castor semilooper, kumbly hula, rice case worm, sugar-cane borer were all promptly reported to the section. Further, assistance was rendered in the remedial measures against all the pests, notably castor looper, rice case worm, in the Channapatna Range, sugar-cane borer in practically every range, principally Mysore, and kamblihula work in the Kolar range. The pest has been so bad here that several hoblies have now been brought under the Pest Act, and a large staff has been at work carrying on remedial measures in which the District staff is actively participating.

(*c*) *Mycological Section.*—The staff is co-operating in the study and eradication of the smut disease on ragi, which has been severe in the Dodballapur and Kolar ranges, the remedial measure against *anabe* of areca-nut in Kunigal taluk and against betel vine mildew in the Kolar range.

(*d*) *Botanical Section.*—The laying out of test plots of the varieties pronounced fit for trial in the Districts such as sugar-cane, ragi, paddy, etc., supervision and assistance at harvest time in measuring crop yields has been attended to by the District staff in all the ranges.

(*e*) *Sericulture.*—The staff has visited 57 mulberry gardens for assistance in regard to manure. Thirty maunds of oilcake and ammonium sulphate have been supplied as manure for mulberry. Sixty-two applications for mulberry cuttings, and 28 for disease-free eggs were forwarded to the Sericultural Department.

(*f*) *Veterinary.*—The staff has largely advertised and popularised the scheme of the itinerant bulls and the castration of scrub cattle; 15 cases of outbreaks of anthrax in Chintamani, Kolar and Chikballapur ranges, one case of foot and mouth disease in Chikballapur and 143 of black quarter in Dodballapur, Maddur and Channapatna were brought to the notice of the Veterinary Department. The Agricultural Inspectors have also accompanied Veterinary Inspectors in connection with remedial work.

(*g*) *Live Stock.*—The chief centre of activity in the Districts of the Live Stock Expert has been Kolar as before; the Agricultural Inspector has continued to be the Secretary of the Kolar Sheep Breeders' Association in which he has been able to show an excellent record; 75 members are on the rolls, 200 sheep and 10 cross bred rams were supplied; 4,024 dipped and clipped. In fact this Agricultural Inspector has had almost as much to do with live stock work as with his other duties.

The Agricultural Inspectors of Yedatore, Tiptur and Tumkur have all helped the Live Stock Section in the purchase of white sheep for the foundation stock at the sheep farm.

63. *Assistance by District Boards.*—The District Boards of Tumkur, Bangalore and Kolar sanctioned Rs. 100, 100 and 200 each, respectively, for the award of prizes in the standing crop competition of H. 22 ragi. The District Board of Kolar has in addition voted a further sum of Rs. 50 towards the freight charges on

the new varieties of canes supplied in that District. The District Board maintained also a good herd of cross bred sheep for the benefit of the sheep breeders of the District.

64. *Agricultural and Experimental Union.*—Among the members of the Union 45 carried out work in conjunction with the department and according to plans supplied. Most of them have taken great pains in carrying out the work successfully and have also reported results. Their names and the work carried out by them in the year are given in Statement' F.'

65. *The District and Taluk Conferences.*—As in former years, the District and Taluk Conferences have all been attended by the staff at which the work of the department in the respective areas was discussed and demonstrations and lectures held. The District conference at Tumkur was presided over by the Officiating Director of Agriculture, the Kolar Conference by the Live Stock Expert and the Bangalore Conference by myself.

66. Agricultural Inspectors have continued to make use of all opportunities of meeting raiyats in order to explain and popularize the implements recommended by the department. Sante gatherings, Jamabandi meetings, meetings of co-operative societies, taluk and hobli conference meetings have all been attended to as far as their other work would permit. The number of such gatherings attended and addressed by the Agricultural Inspectors is given below :—

Range	Number of meetings Attended			Taluk and District Board Meetings and Taluk, Hobli and District Conferences
	Jatras and Santes	Jamabandi	Co-operative societies	
Bangalore	...	...	2	5
Dodballapur	3	...	1	3
Channapatna	20	4	20	14
Kolar	75	14	47	19
Chintamani	10	1	5	13
Chikballapur	15	...	40	9
Tumkur	54	1	20	12
Maddagiri	39	...	11	4
Tiptur	50	...	15	4
Mysore	30	...	6	6
Maddur	1	...	3	4
			3	
Yedatore	10	...	27	7
Chamrajnagar	28	...	4	3

67. The depots of the Agricultural Inspectors continued to be popular as may be seen from the number of visitors and the sales at each depot given below :—

Range	Value of sales	Visitors
	Rs.	
Bangalore	13,740	617
Dodballapur	3,672	530
Channapatna	1,738	686
Kolar	2,570	505
Chintamani	1,004	..
Chikballapur	7,967	219
Tumkur	2,278	466
Maddagiri	2,844	1,500
Tiptur	2,203	329
Mysore	2,478	570
Maddur	3,944	...
Chamrajnagar	1,173	456
Yedatore	1,372	100
Total ...	46,983	5,978

A. K. YEGNANARAYANA IYER,
Deputy Director of Agriculture in Mysore.

LEAVE STATEMENT 'A'.

(1) Mr. H. Venkoba Rao, Agricultural Inspector, Dodballapur, was on 15 days' privilege leave from 9th October 1922 to 23rd October 1922.

(2) Mr. C. B. Krishna Murthi, Agricultural Inspector, Maddagiri, was on 1½ months' privilege leave from 28th April 1923 to 12th June 1923.

(3) Mr. M. Seshagiri Rao, Agricultural Inspector, Tiptur, was on 35 days' privilege leave from 23rd April 1923 to 27th May 1923.

(4) Mr. A. K. Narayana Murthi, Agricultural Inspector, Chamrajnagar, was on 3 months and 10 days' combined leave from 23rd July 1922 to 1st November 1922.

(5) Mr. D. Balakrishna Rao, Agricultural Inspector, Yedatore, was on privilege leave for 1 month and 3 days from 25th August 1922 to 26th September 1922.

(6) Mr. K. A. Krishnan, Agricultural Inspector, Nagenhalli Farm, was on privilege leave for 1 month and 14 days from 2nd January 1923 to 15th January 1923 and from 24th May 1923 to 23rd June 1923.

(7) Mr. C. V. Krishna Rao, Agricultural Inspector, Nagenhalli Farm, was on leave on medical certificate for 1⅔ months from 17th July 1922 to end of August 1923.

(8) Mr. K. G. Ramaswamy Iyengar, Head Clerk, Deputy Director's office, was on privilege leave for 2 months and 25 days from 12th May 1923 to 5th August 1923.

(9) Mr. C. Venkatanarayana Iyer, Head Accountant, Deputy Director's office, was on privilege leave for 1 month and 9 days from 8th February 1923 to 25th February 1923 and 23rd April 1923 to 13th May 1923.

(10) Mr. G. N. Krishna Murthi, 2nd Accountant, Deputy Director's office, was on privilege leave for 1 month and 10 days from 5th December 1922 to 15th January 1923.

STATEMENT 'B.'

Results of comparative trials of ragi varieties. (Yields of grain in seers per acre.)

Range	H. 2	H. 13	H. 22	H. 33	H. 39	H. 40	H. 43	H. 44	Local
Bangalore ...	...	...	714	...	...	760	790	...	...
Dodballapur ...	180	...	170	...	...	200	180	147	...
Channapatna ...	...	...	...	...	...	...	...	..	...
Maddur ...	...	...	...	...	...	368	...	352	291 Series I
	769	...	...	...	...	769	...	..	... „ II
	...	...	...	...	650	...	700	..	650 „ III
	...	650	750	...	...	...	...	700	... „ IV
Chintamani ...	...	520	589	513	...	...	504	484	... „ I
	...	740	847	673	...	...	717	753	687 „ II
Mysore ...	...	866	760	570	840	693	933	586	666
Chikballapur ...	...	...	1,110	...	1,200	1,500	1,500	1,410	810
Tumkur ...	164	...	190	...	...	...	...	...	132 Series I
	...	...	620	515	490	...	525	540	510 „ II
	...	...	526	526	421	..	456	351	456 „ III
Maddagiri ...	...	...	...	...	...	440	450	..	400
Chikkanhalli ...	357	300	285	...	328	314	307	..	...
Nagenhalli Farm ...	...	...	484	..	...	..	..	..	558

STATEMENT 'C'.

Groundnuts Distribution.

Range	Variety	Quantity distributed in Range	Remarks as to yield
		Seers	
Channapatna ..	Spanish ..	100	600 seers per acre.
Dodballapur ..		Nil	
Tumkur ..	Sugatur ..	Not furnished	713 lbs.
	Mauritius ..	,,	697 ,,
	Carolina ..	,,	653 ,,
	Local ..	,,	418 ,,
Maddagiri ..	Sugatur ..	,,	1,760 seers per acre.
	Barbados ..	,,	2,640 ,,
	Transval ..	,,	1,173 ,,
Kolar ..	Virginia ..	100	Yields very satisfactory as compared with local varieties.
	Spanish ..	297	,,
Chikballapur ..		307	Satisfactory.
Chintamani ..		103	
Mysore ..	Small Japan ..	549	500 seers per acre.
Chamrajnagar ..		18½	Satisfactory.
Tiptur ..	Spanish ..	176	1,812 seers per acre.
Bangalore ..	Mauritius ..	82½	730 ,,
	Barbados ..	5	Average of 8 pallas per acre.
	Sugatur ..	5	
	Carolina ..	5	

STATEMENT 'D'.

Name of Society	Amount voted	Articles supplied	Value
Bangalore Range.	Rs.		Rs.
Tyamagondlu	100	6 cwts. of ammonium sulphate.	
Jakkanhalli	140	2 do do	
Tumkur Range.			
Herur	25	100 seers of H. 22 ragi, 1 Eureka plough.	25
		50 seers of H. 22 ragi, 3 Meston shares	13
Kottagere	13	1 F. 4. steel share	
Kunigal	100	2 K. M. ploughs	
		1 Eureka plough	100
Tiptur Range.		150 seers of H. 22 ragi, 2 shares, 6 mds. Super.	
Nonavinkere	250	2 Eureka ploughs	
		200 seers H. 22 ragi	
		105 seers sunnhemp seeds ..	142
		2 K. M. ploughs	
		2 Cultivators	
Honnavalli	200	4 Eureka ploughs	
		2 K. M. ploughs	
		200 seers H. 22 ragi	200
		2 pallas sunnhemp	
		10 Mds. cocoanut mixture ..	
Chiknaikanhalli	100	1 K. M. plough	
		2 Eureka ploughs	
		100 seers H. 22 ragi	100
		100 seers sunnhemp	
		Vegetable seeds	
Sira Vartaka Sangha	100	do	100

STATEMENT 'D'—*concld.*

Name of Society	Amount voted	Articles supplied	Value
Maddagiri Range.	Rs.		Rs.
Kodigenhalli	150	H. 22 ragi and K. M. plough ..	..
Chandragiri	100	Superphosphate	..
Badavanhalli	100	do	..
Midigesi	150	..	..
Kolar Range.			
Mulbagal	300	4 ploughs, shares, H. 22 ragi and ammonium sulphate.	398
Mudayanur	100	Paddy	100
Devarayasamudram	100	Seeds, manures and implements ..	100
Sundrapalya	400	do	..
Bowringpet	150	H. 22 ragi	30
Malur	200	H. 22 ragi and ammonium sulphate ..	35
Srinivaspur	200	H. 22 ragi, ammonium sulphate and implements.	116
Chikballapur Range.			
Chikballapur	2,000	Seeds, manures and implements ..	..
Manchenhalli	1,000	Ammonium sulphate	180
Goribidnur	2,000		
Varlakonda	..	H. 22 ragi	29
Hudugur	..	do	38
Hosur	..	do	38
Sabbanhalli	..	do	57
Chintamani Range.			
Basettihalli	100	Implements, seeds and manures ..	..
Chintamani	500		
Chamrajnagar Range.			
Nanjangud	100	Implements, seeds and manures ..	134
Yelandur	300	Nagpur fine paddy and H. 22 ragi ..	..
Gundlupet	..	3 Eureka ploughs	..
Yedatore Range.			
Periyapatna	..	Shares and points	..
Hunsur	..	Banku paddy 180 seers	..
Maddur Range.			
Malvalli	500	Work not commenced yet ..	.
Maddur	500	do	..

STATEMENT 'E'.

Name of Co-operative Society	Articles sold
Bangalore District.—	
1. Vartur	
2. Vasantapur	
3. Chikbanavar	
4. Ramohalli	
5. Bagalgunte	
6. Medihalli	
7. Bukkasagara	
8. Attibele	
9. Sarjapur	Seeds, manures and implements.
10. Sakalavara	
11. Oblapur	
12. Manne	
13. Mahadevapur	
14. Arasinakunte	
15. Tyamagondlu	
16. Jakkanahalli	
17. Begur	
18. Kalammanahalli	
19. Magadi	Do
20. Tavarekere	H. 22 ragi.
21. Closepet	H. 22 ragi, 2 Nahan mills and 1 cultivator.
22. Archakarahalli	H. 22 ragi.
23. Settihalli	Do
24. Harohalli	H. 22 ragi and 1 Nahan mill.
25. Dayara	3 Nahan mills.
Kolar District.—	
26. Nernahalli	H. 22 ragi and H. M. 544 cane setts.
27. Mudayanur	2 ploughs and cultivator, groundnuts, H. 22 ragi, jola and paddy.
28. Sugatur	H. 22 ragi, H. M. 544 cane setts, ammonium sulphate and paddy mixtures.
29. Nonamangala	H. 22 ragi.
30. Vorlakonda	Do
31. Sabbanahalli	Do
umkur District.—	
32. Annenahalli	
33. Kestur	
34. Kunigal	Seeds, manures and implements.
35. Amrutur	
36. Tumkur	
37. Bidarkere	Meston plough.
38. Mayasandra	
39. Thandaga	
40. Mavinkere	
41. Kanathur	
42. Nonavinkere	K. M. ploughs, cultivators, shares, Meston ploughs, and H. 22 ragi.
43. Turuvekere	
44. Kadehalli	
Mysore District.—	
45. Malvalli	Kapilesanna paddy.
46. Maddur	Eureka plough.
47. Yelevala	Vegetable seeds.
48. Sakkahalli	H. 22 ragi, ploughs, cultivators, sugar-cane setts, paddy, and paddy mixture.
49. Periyapatna	
50. Hunsur	

STATEMENT 'F'.

Range	Name of member who undertook the experiment	Kind of experiment	Results
Bangalore ...	Mr. B. Narasinga Rao ...	Groundnut ...	Satisfactory.
	„ T. Venkatanarayana Setty	Sugarcane ...	do
		Red Mauritius, H. M. 544 and 320.	
	„ R. Gopalaswamy Iyer ...	Plough (New Hebbal)...	do
	„ B. Sreenivasiengar ...	do ...	do
	„ A. T. Mac Isaac ...	do ...	do
	„ M. S. Linge Gowda ...	do ...	do
Dodballapur	„ Ramachandra Sastry ...	do ...	Not sufficiently used.
	„ B. Venkatanaranappa ...	Ragi selections, H. M. 544 cane.	Results not uniform.
Channapatna	„ Mukunda Rao ...	Ragi and castor ...	Yield of ragi good; castor failure.
Kolar Range	„ Nagegowda ...	Plough trial ...	Satisfactory.
	„ M. N. Shamayya ...	Ragi and Groundnut varieties.	Good.
	„ Sreenivasa Rao ...	do ...	do
	„ Naranayya ...	Groundnut trial ...	do
	„ K. M. Ramiah Setty ...	Ragi and groundnut ...	do
	„ Nagegowda ...	Sugarcane ...	do
Chintamani	„ Shankarappa ...	Ragi ...	do
	„ Munisamegowda ...	do ...	do
	„ Talagawara Thimmiah ...	do ...	do
	„ Hampiah, Sidlaghatta ...	do ...	do
Chikballapur	„ Chikkegowda ...	Cane varieties ...	do
	„ Lakshman Reddy ...	Ragi, sugarcane, castor and groundnut.	do
Tumkur ...	„ A Subramanyam ...	Ragi, groundnut and castor.	do
	„ A. S. Venkatakrishnappa ...	Ragi ...	do
	„ Channabasavegowda ...	Groundnut ...	do
	„ C. Narasimha Iyengar ...	Paddy mixture ...	do
	„ M. K. Ramaswamy Iyengar	do ...	do
	„ Sivalingayya ...	Economic transplanting H. M. 544 and ammonium sulphate for cane.	do
Maddagiri ...	„ Hanumantha Setty ...	Ragi 4½ pallas per acre. Groundnut 11—26 pallas per acre. Castor failed.	
Mysore ...	„ Gouse Peer Sahib ...	H. M. 544 cane setts ...	Very popular.
	„ M. P. Subramanyaraja Urs	Ragi 4·47 pallas ...	Gave good yields.
	„ Narasimhachar ...	Paddy ...	Attack from case worm; kerosine emulsion treatment.
Maddur ...	„ Nanjappa ...	Ragi ...	Satisfactory.
	„ Madappa ...	do ...	do
	„ Kadappa ...	do ...	do
	„ Mastan Beig Sahib ...	Paddy and castor ...	do
	„ Lingayya ...	Groundnut ...	do
Chamrajnagar.	„ Siva Rao ...	New Hebbal plough ...	do
	„ C. Venkata Rao ...	do ...	do
	„ A Ramaswami Iyer ...	do ...	do
Yedatore ...	„ Ningegowda, Tippur ...	Sugarcane ...	Area increasing.
		Ragi ...	Ragi failure owing to want of timely rains.
		Groundnut ...	Failure.
	„ Nagabhushana Rao ...	Sugarcane, ragi and groundnut	do
	„ Chandrasekharaiya ...	Sugarcane varieties ...	Water difficulty; hence given up.
	„ Ramaswamy Sastry and B. Sreenivasiengar.	do ...	do

Report of the Sri Krishna Rajendra Vyavasaya Dharma Patasa Chikkanhalli, for 1922-23.

1. Mr. A. Venkataramaiya was in charge of the School as Head-Master throughout the year.

2. The year opened with eight students on the rolls. During the year, seven more students were admitted, of whom three dropped off, leaving a total of twelve students on the rolls at the end of the year.

3. The prescribed syllabus of studies, both theory and practice, was gone through. As in the previous year Veterinary instruction was imparted to the students in part by the Veterinary Inspector, Maddagiri. The students were taken on excursions to the neighbouring villages to acquaint them with the symptoms of diseases of cattle that were prevalent there and also to make a study of the different breeds of cattle. In these tours, they castrated several bulls, and thereby got good practice in castration.

4. As usual all the practical work on the Farm was done by the students themselves. The practice of taking the students to the Government farms on an excursion was given up for want of funds.

5. The carpentry and smithy classes were wound up last year by the Department of Education to curtail expenditure. The restoration of these classes was not possible this year for want of funds. Hence the present batch of students did not have the advantage of these classes, which their predecessors received.

6. Practice in jaggory boiling was also given to the students but owing to the small area of the school farm enough sugarcane could not be grown for a thorough practice.

7. The students helped the raiyats in the fitting up of the Nahan mills.

8. The attendance of the students was fairly regular and their health was good. The Sub-Assistant Surgeon at Sira continued his weekly visits to the School to render medical aid as usual.

9. The twelve successful students of the year 1921-22 were awarded prizes and certificates by the President of the School.

10. The debating society was fairly active throughout the year and the students took lively interest in the games.

11. As usual, the students maintained a good flower garden in front of the school and also a kitchen garden in the school wet land.

12. On wet area, sugarcane, paddy and irrigated ragi were the main crops. Kapile sanna and Halubbalu were the two varieties of paddy that were grown on the Farm. The economic transplantation of paddy was demonstrated to the students. The following experiments were designed for demonstration to the students:—

(1) Manurial trial with Rasathale, H. M. 544, R. M., H. M. 315, J. 33—A and Pattapatti varieties of sugarcane with oilcake and oil cake plus sulphate of ammonia manuring.

(2) Varietal tests with Red Mauritius, H. M. 544, J. 33—A, Rastali, Pattapatti and a number of Hebbal seedling canes.

(3) Manurial test with paddy with Hongey leaves and Hongey leaves plus superphosphate manuring.

(4) Manurial test with irrigated ragi with cattle manure and cattle manure plus artificials.

13. Besides the main crops mentioned above, onions, garlic, a mixture of cowpea, sunflower and jola for fodder purposes were grown on small bits of land.

14. On the dry land in addition to observation plots, fodder jola, different varieties of castor, ragi and groundnuts were grown. Horsegram was mixed with fodder jola and sown on the outskirts for fodder purposes.

15. Mulberry was grown on the outskirts of the wet area, and the leaves were utilised for a small beginning in silk worm rearing. Eggs were supplied by the Sericultural Department and one complete rearing was conducted by the students of this year.

16. The following implements were sold in the Implement Depot attached to the School.

4. K. M. slip points.
1. K. M Entire share.
4. K. M. slip point shares.
1. K. M. Landside.

The school also sold 290 seers of H. 22 seed ragi and 400 setts of sugarcane to the raiyats of the neighbourhood.

16a. During the Santes, demonstration and lectures were held as usual, on subjects appropriate to the various seasons.

17. During the year under report, the school building and the 6½ acres of land attached thereto were formally handed over to Government by the donor Mr. Anniah. The school also had the honor of being named after His Highness the Maharaja, with his gracious permission, and the ceremony of unveiling the marble tablet bearing the new name "Sri Krishnarajendra Vyavasaya Dharma Patasala, Chikkanhalli" was performed by the Dewan Mr. A. R. Banerji, M.A., C.S.I., C.I.E.

A. K. YEGNANARAYANA IYER,
Deputy Director of Agriculture.

Annual Report of the Nagenhalli Farm for 1922-23.

Staff.—Mr. P. Ramaswamiengar continued to be in charge of the Farm as Farm Manager throughout the year. There were frequent changes in the personnel of the Farm Assistants during the year. Probationary Agricultural Inspector D. Venkataramanaiya, who was Assistant Manager in the early part of the year was transferred to the Western Division and his place was taken by Mr. K. A. Krishnan, Agricultural Inspector. The latter was also absent on privilege leave for one month and 14 days, during which period probationary Agricultural Inspector, C. V. Krishna Rao was posted for duty on the Farm.

Season.—The total rainfall of the year amounted to 30·40 inches as against 26·68 inches in the previous year. Though the actual amount was thus higher by about 4 inches, the dry crops were not particularly benefited; the early mungar jola crop failed to mature a crop, and even the hain crop of ragi yielded only moderately. The soils of the Farm are such that crops cannot withstand even a short break of about a fortnight of rainless weather. As regards irrigation, the main rainy season irrigation was ample and satisfactory, so that neither sugarcane nor paddy suffered in any way for want of irrigation in the main monsoon season. The hot weather supply of irrigation water for the calendar year 1923 was however seriously and unexpectedly interrupted towards the end of May, as the water in the reservoir went below sluice level owing to delay in the breaking out of the monsoon. Normal supply was restored only after a break of about three weeks. This was however too severe for the young crop of cane planted in the current season, which consequently suffered seriously. This is the second time there has been serious trouble with irrigation. Last year owing to the fact that water could not be let into the low level channel owing to the work of construction of a tunnel at the dam not being ready in time, arrangements had to be made for irrigation by pumping. This year owing to an unexpected shortage of water in the reservoir itself, pumping had likewise to be resorted to. As this latter cause has always to be reckoned with, in order to avoid risk of serious damage to the sugarcane crop, a permanent pumping installation is necessary.

Buildings, Roads, etc.—No new building of any permanent character was put up, although there are no proper quarters for the Assistant Manager and clerk who are put to great inconvenience which in its turn seriously affects the efficiency of the work. A lodge for visitors or some kind of accommodation for men coming to

the farm for a short course of study or practice is also a great need, which deserves to be met as early as possible. The labourers have been housed in wretched huts and proper quarters for them has also been a crying need. About 150 yards of a new road were opened and some additional land levelled and made fit for wet cultivation.

In the middle of the sugarcane milling season a severe storm passed over the farm and considerable damage to the milling shed and farm buildings was done. The milling shed which was only a temporary structure came down and the roofs of the farm office and store and of the Manager's quarters were partly blown away. There was fortunately no loss of life, though work was in full swing in the jaggory boiling shed at the time.

Area under cultivation.—The total area under cultivation both dry and wet during the year, was 43¼ acres.

Sugarcane and paddy on the wet area and ragi, jola and horsegram and castor on the dry area were the crops raised as described below in detail.

(*a*) Dry Crops—

(1) *Ragi.*—The comparative test of the local Hullubele ragi against the strain H. 22 was continued in this year also. The plots were as usual laid out in triplicate and the results are as below:—

Variety	Yield per acre 1922-23.		Yield per acre 1921-22.	
	Grain in srs.	Straw in lbs.	Grain in srs.	Straw in lbs.
Local Hullubele	558	1,340	354	2,924
H. 22 do	484	1,042	300	2,628

In two successive years, the local ragi has yielded better than H. 22 under the conditions of the Farm. In the current season some of the new Hullubele selections from the Hebbal Farm have been included in the test and the results will be available later on.

(2) *Jola.*—According to local practice jola was shown as an early mungar crop on an area of 4½ acres. Owing to want of timely rains, the crop did not grow well enough to mature grain. It was therefore used as fodder; it provided feed for one month and 9 days to the six pairs of working bullocks on the farm.

(3) *Horsegram.*—On the jola stubble, horsegram was grown as a second crop; the season for this crop was favourable and the crop yielded at the rate of 283 seers of horsegram per acre, as against 115 seers in the previous year.

(4) *Castor.*—Six selected varieties of castor sent out from the Hebbal Farm were tested on plots laid out with the usual repetitions. The seed was sown in plough furrows and later the interspaces were hoed with the Doddakunte. The yield of the several varieties is as given below:—

Variety	Yield of clean seed per acre, in seers
H. 3	234 (1 seer of castor weighs 1·64 lbs. on an average.)
H. 1	159
H. 3	181
H. 5	137
H. 6	141
H. 8	135
Local	230

The seeds of variety H. 1 were supplied in small quantities to raiyats in the current season.

(*b*) Wet crops—

1. *Paddy—General.*—The area under paddy in the year was 22·9 acres as against 17·9 acres in the previous year. Though individual plots have yielded up to 18 pallas of paddy per acre, still the average for the whole farm has been only 11 pallas per acre, the total produce of paddy for the year being 252 pallas and 77 seers.

The varieties grown as bulk varieties were the following and the yield per acre of each variety is as given below :—

Variety	Area on which grown		Yield per acre of grain in seers
	Acres	Guntas	
1. Banku	7	20	988
2. Natnahalli Sanna	1	20	1,160
3. Patsomanhalli Sanna	8	10	1,223
4. Kaddi Sanna	4	0	1,248

In addition to these varieties, tests of 12 other varieties were conducted alongside of these on small 2 guntas plots, with a view to study their characters. Their season of growth and the yield are given in the following table :—

Paddy—District Varieties (tried on 2 gunta plots) 1922-23.

No.	Variety	Date of transplanting	Date of harvesting	Yield per acre	
				Grain	Straw
				Seers.	lbs.
1	Banku	5-8-22	22-11-22	990	2,000
2	Anekal Sanna	,,	,,	890	1,880
3	Gareke sanna	,,	,,	460	1,200
4	Mudaganti sanna	,,	23-11-22	590	1,820
5	Halubbalu	,,	6-12-22	800	2,180
6	Natnahalli sanna	,,	,,	1,000	3,200
7	Bili sanna	,,	14-12-22	760	2,530
8	Patsomanahalli (early) ..	,,	,,	1,120	1,825
9	Gamalada	,,	,,	800	2,022
10	Saklati sanna	,,	15-12-22	600	1,765
11	Hottekembuti	,,	,,	1,500	3,960
12	Karkalu ..	,,	23-12-22	1,350	3,520
13	Dharapura sanna	,,	,,	840	2,790
14	Balamallige	,,	,,	1,275	3,020
15	Poona sanna	,,	27-12-22	1,310	3,100
16	Kembuti	,,	28-12-22	920	2,120

The poor yielders among the above have been left out in the current year's trials and some other varieties sent out from the districts as high yielders have been included instead. Among these are two selections from the Paddy Breeding Station of the Madras Department of Agriculture.

Manurial trials with paddy—

(*a*) One set of experiments was arranged to test the value of superphosphate of lime as a manure for paddy on these soils in conjunction with green manure which is about the sole manure used for paddy in these parts (sunnhemp). The variety of paddy used for the test was Banku, and the tests were arranged in triplicate. The results are as given below :—

Green manure *vs.* green manure and superphosphate (average yield of 3 plots) Variety-Banku. 1922-23.

		Name of manure for one acre		Yield per acre	
		Kind	Quantity	Grain	Straw
			lbs.	Seers.	lbs.
1	No manure ..	....	..	1,152	1,959
2	Green manure ..	Sunnhemp ..	6,000	1,401	2,355
3	Green manure and superphosphate.	Sunnhemp and superphosphate ..	6,000 / 160	1,526	2,766

The increase of yield by the use of the superphosphate with green manure over the yield of the green manure alone is thus about 125 seers of the value of Rs. 13, while the cost of the superphosphate comes to Rs. 7. With a view to finding out to what extent a further dose of superphosphate will be profitable, in the current season additional plots have been laid out and the experiment continued.

(b) The use of a mixture of oilcake with superphosphate to supplement a heavy dose of green manure was tested in a set of experiments which was also conducted in triplicate, the variety of paddy grown being Pattasomanahalli. The results are as given below :—

Ordinary dose of paddy mixture *vs.* heavy dose of paddy mixture (average yield of 3 plots). Variety-Pattasomanahalli sanna. Sunnhemp is the common dose of manure at 6,000 lbs. per acre, for all the 3 plots.

		Name of manure for an acre		Yield per acre	
		Kind	Quantity	Grain	Straw
			lbs.	seers	lbs.
1	....	6,000 lbs. of green manure	..	1,140	3,140
2	Ordinary dose of manure ..	6,000 lbs. of green manure and paddy mixture.	360	1,260	3,770
2	Heavy dose of manure ..	6,000 lbs. of green manure and paddy mixture.	1,240	1,550	4,690

The increased yields given by the mixture have not been sufficiently great to make the mixture profitable when applied over and above a heavy dose of green manure. Were the manures cheaper the increases would be more telling, financially.

(c) The value of lantana as green manure has been tested in another set of experiments as in the last year; the plots were laid out in triplicate as usual; the variety of paddy grown was Pattasomanhalli. The results which are given below show that though the lantana did not give as high an increased yield over the no manure plot as the sunnhemp, still the increase is sufficiently high to justify its being used with profit. In any case it demonstrates one advantageous way of keeping the lantana in check.

Lantana *vs.* Sunnhemp (Average yield of 3 plots) Variety-Pattasomanhalli-sanna 1922-23. 1—40 acre plots.

No.	Kind of manure	Quantity per acre	Yield per acre		Remarks
			Grain	Straw	
		lbs.	seers	lbs.	
1	No manure	...	1,240	4,387	
2	Sunnhemp	8,000	1,713	5,760	
3	Lantana	8,000	1,513	4,520	

(d) The practice of transplanting in singles as against in bunches containing or 4 seedlings does not appear to be advantageous on the poor and raw soils of this Farm. The methods were tested on four varieties of paddy and on plots laid out in triplicate. A general manuring with sunnhemp grown and ploughed in as green manure was given to all the plots. The results are given in the following table :—

Paddy.—Singles *vs.* Bunches (Average yield of 4 plots, manured with sunnhemp) 1922-23.

No.	Name of variety	Yield per acre			
		Singles		Bunches	
		Grain	Straw	Grain	Straw
		seers	lbs.	seers	lbs.
1	Banku	1,347	3,793	1,473	4,409
2	Natnahalli sanna	1,225	3,157	1,257	3,664
3	Kembuthi	1,765	4,660	1,817	4,912
4	Kaddi .. .	1,435	2,427	1,496	2,960

Sugar-cane.—The area under sugar-cane in the year was 10 acres and 35 guntas. Five varieties in all were planted as the main varieties as shown below:—

	Acres	Guntas.
Red Mauritius	1	35
H. M. 544	3	20
H. M. 342	1	2
H. M. 310	0	30
Pattapatti	3	0

In addition, the twelve varieties of seedling canes selected out of the large number sent in the previous year from the Hebbal Farm were also put out for trial on a small area of 10 guntas.

As explained in the previous year's report, this year's cane crop suffered seriously for want of water in the initial stages. The seed setts were got mostly from Mr. McIsaac's village near Tavarekere 14 miles from Bangalore, and the quality of the seed deteriorated badly by this long transport by rail and cart. The germination was very poor and blanks were numerous. Added to this was a serious breakdown in the irrigation which was so bad that the cane crop was not expected to yield any crop worth mentioning. The H. M. 544 cane also developed numerous clumps in which the cane ran into a kind of shrublike growth and the attack of the sugar cane borer was also severe.

The yields of the varieties in this year cannot be therefore taken as accurate data about the merits of the different varieties.

Varietal test.—The yield of canes per acre harvested from the different varieties were as below:—

Variety	Tons of cane per acre		Remarks
	Tons.	lbs.	
H. M. 210	30	1,733	
H. M. 544	7	893	All except 544 are from seed raised on the farm itself.
Pattapatti	17	1,520	
H. M. 539	25	1,933	
Kassoor	28	787	
H. M. 600	20	1,693	
H. M. 602	12	400	
H. M. 131	24	1,387	
H. M. 315	25	27	
Red Mauritius	30	2,027	

Superphosphate manuring for cane.—In addition to the varietal test, one series of experiment was laid out to test the effect of superphosphate as an additional dose to the usual nitrogenous manuring. The variety of cane used was pattapatti. It was found that the canes so manured were richer than the check canes, though in the actual tonnage of cane per acre, there was little difference. The results are given in the following tables:—

Manure *vs.* no manure (Average of two series). Variety-Pattapatti 1922-23.

Name of manure	Quantity per acre	Yield per acre		Yield of Jaggory	
		Tons	lbs.	Per acre lbs.	Brix
	lbs.				
1. No supers	...	14	1,403	3,480	19
2. Superphosphate	500	13	1,771	3,629	20

Oil cake at the rate of one ton per acre and ammonium sulphate at 250 lbs. an acre are general applications for both the experiments.

Milling and jaggory boiling.—As was done last year, the milling of cane was done by the small power mill which was got from the Hebbal Farm. The percentage of extraction during the year was lower than last year and so the percentage of jaggory to cane works out only to 9·82, whereas, in the previous year it was 11·9. The milling continued from 23rd March 1923 to 9th May 1923 on which day one of the big wheels of the crushing mill was broken and the broken part was sent to Bangalore to get a new one made. It took nearly 1½ month's time and milling again commenced from the 18th June 1923 and with short breaks in the middle, was completed on 23rd July 1923.

The following table shows the weight of cane produced on the Farm :—

Area	1921-22	1922-23
	12 Acres	10 Acres 35 Guntas
Total weight of cane	2,97,759 lbs.	2,84,198 lbs.
Tonnage of cane per acre	10·07 tons.	11·66 tons.
Weight of cane sold as seed...	2,856 lbs.	12,132 lbs.
Do used on the Farm	31,006 lbs.	39,706 lbs.
Do milled	2,38,185 lbs.	2,32,560 lbs.
Weight of jaggory obtained...	28,358 lbs.	22,819 lbs.
Percentage of cane to jaggory	11·9	9·82

Receipts and Expenditure.

Receipts		Expenditure	
	Rs.		Rs.
Value of Farm produce of all kinds	5,797	Recurring.	
		Labour	3,425
		Live Stock	427
		Seeds and manures	2,187
		Implements	589
		Contingencies	847
		Total ...	7,475
		Non-recurring.	
		Building	585
		Levelling	347
		Implements	351
		Fencing	67
		Miscellaneous	75
		Total ..	1,425

General.—Not only the farm canes were milled here, but also the canes of some of the cane growers of the Nagenhalli village who were permitted to have their canes milled here by the power mill, were milled and they were charged a nominal rent of Rs. 3 per day. The total hire realised therefrom is only Rs. 36, as the mill became damaged in the course of the milling and this work had to be stopped. Otherwise, the whole of the raiyats' canes of this village would have been milled in the Farm mill.

A. K. YEGNANARAYANA IYER,
Deputy Director of Agriculture.

REPORT OF THE WESTERN DIVISION FOR THE YEAR 1922-23.

As usual I continued to be in charge of the Division. My itineration rose to 222 days in the year.

There was not much change in the staff which, I must again say, has worked very satisfactorily and tended to the large increase in the volume of work that is detailed in the pages to follow.

As there was a special scope for the introduction of supers for paddy in the rainless but industrious taluks of Challakere and Molakalmuru, a wholetime man was deputed mainly for doing propaganda for this improvement with headquarters at Challakere. Mr. K. H. Balaji Rao, who was transferred from the Botanical Section, was put in charge of this.

Mr. Sharma of Hole-Narsipur was drafted to the Botanical Section and K. V. Ramaswami was posted to his place.

Mr. A. K. Narayanamurti was taken to the Eastern Division and the Hiriyur Range was abolished and that Taluk was tacked on to Chitaldrug, K. Nagappaiya being placed in charge of the newly constituted range.

Leave.—Only two of my Inspectors took leave during the year. Mr. Chayapati of Sagar absented himself for 27 days during which period, K. Narayanachar of Marthur acted for him. Mr. Gopala Rao of Tarikere fell ill and went on two months' privilege leave. As usual his brother at Chikmagalur bore this burden in addition to his own.

Correspondence.—The correspondence is still on the increase. The incoming letters have risen in number from 7,522 to 8,680 and the outgoing from 7,854 to 9,810.

Meetings attended.—I took part in the deliberations of all the District Conferences of my Division except that I was, owing to illness, prevented from going to the Chitaldrug meeting. My Inspectors attended all the Taluk Conferences without any exception.

Seasonal prospects.—The pre-monsoon showers of 1922 were good and the egular monsoon began well. There, however, soon followed a severe dry spell which specially affected the dry crops. The Malnad had a peculiarly bumper harvest. Shimoga and Shikarpur Taluks suffered the most as usual. Prices of all agricultural produce fell considerably and jaggory seems to be the special victim of this slump in the market. The avenues of exit seem as if closed for this commodity and material worth lakhs of rupees is sitting hard as dead stock with the cane grower. Jaggory is not wanted even at Rs. 2 a maund, and this has almost brought about an economical dislocation in the Shikarpur Taluk. It is no wonder that the cane area has proportionately gone down everywhere.

Implements and their demonstration.—I have to repeat the same sad tale of last year. The heavy price of the ploughs has been an irresistible bar to their introduction. The cost of wearing parts, which has also risen, seems to act as a strong limiting factor in the use of the improved implements. A poor raiyat will certainly demur to spend three rupees for a share which often wears away before he gets through an acre. Now that a satisfactory bar-share plough has come into existence, the introduction of improved implements may hereafter have a happy augury. In the black soil area, theheavy Kirloskar seems to be gaining ground. From Chitaldrug

it has slowly travelled to Sivani and Ajjampur in Tarikere Taluk. Further south at Kadur and Arsikere, it seems to have caught the favourable eye of the black soil cultivator. Though a costly thing, it is the one implement that has a great future and an unrestricted field for its rapid spread. It would have diffused itself much quicker, had it not been for the cheaper types of plough being offered in the market. The Bar Share plough which is offered at nearly Rs. 30 a piece, has even come in the way of the Verity. Even though we have reduced the price of this last implement to Rs. 45 at great sacrifice, its sales have not improved. People are demanding the beautiful Verity with all its polished steel in it for only Rs. 30 or the price offered for the far inferior Bar Share plough. The raiyat is easily satisfied if his immediate needs are met and does not further exercise his discriminatory power to separate good from bad things. With all these disadvantages, we have sold 116 Meston as against 108, 32 Kolar Mission as against 20, 40 Eureka as against 88, 21 Verity as against 6, and 106 Kirloskar as against 85, or 315 in all as against 318 sold last season. An equal number of Kirloskar ploughs has probably been vended by private people at Davangere. We have given out 1,639 spare parts as against 1,429 done last year.

We have sold only 7 cultivators as against 6 in the previous year. Cheap cultivators of 3 or 4 tynes are under preparation and will be tried this season at various places.

The stone rollers are now being got manufactured and bought by the cultivators of their own accord. All my Inspectors are doing each to preach and put the idea into their head. The roller is now used for threshing all kinds of grains including pulses. The intelligent coffee planter has begun to take advantage of it for milling his sundried cherry.

Owing to severe restrictions on touring we have held only 395 demonstrations with the plough as against 642 done during the last year. As I have once before said, these demonstrations must get less and less day by day unless we put on the anvil a new kind of implement and feel anxious to advertise it.

Sugar-cane.—A major portion of our energy is being devoted to the pushing on of new varieties of cane.

Java is becoming almost universal and has spread far and wide in all shades of climate from arid Arsikere to humid Nagar. Whole areas of 50 to 100 acres commanded by tanks are under it in the Arsikere, Belur, Chikmagalur and Kadur Taluks. From the excellent jaggory it makes, it gains its attraction. It is again the earliest maturing of all canes we have. The strong point possessed by it forms the vortex of its successful introduction in the Kadur and Hassan Districts where the ordinary cane is of 18 months duration. Roughly estimated, it occupies nearly 1,000 acres in this division. I even understand that it has descended down the ghats and spread itself in the West Coast. In its total tonnage it is not much superior to the local striped and its drawback is that it does not tiller very well. Application of ammonium sulphate in the early stages of its growth will probably force it and induce it to tiller better. The Department has in all distributed 4,00,000 of its setts.

H. M. 544 is another cane that we are striving hard to introduce. Its drought resisting character was admirable in the Shikarpur Taluk where it remained uneffected in dry condition though the rains held off for months, while the local striped had at the same time dried completely root and branch. From a few guntas for which seed was supplied last year from the Babboor Farm, it has spread to 10 acres this time at Shikarpur. Mr. Subramhanya Bhatta grew it successfully at Tenginakere and has been responsible for 4 or 5 acres of it in the Tirthahalli Taluk. It is estimated that it has covered an area of 10 acres in the Hiriyur Taluk chiefly from seed supplied by the Babboor Farm. Near Davangere, it has slowly scattered itself over another 8 acres. At Sakrepatna where it had been taken up in right earnest the previous year, the growers wanted to know what its performance would be in respect of producing jaggory. They had thus to wait long until the planting season was well nigh over. It has thus occupied hardly 20 acres here or only the same area as it did last year. From Sakrepatna, it has filtered itself to Arsikere where it now covers five acres. It has also extended to five acres near Halebid. We have thus taken extreme pains to disseminate it all over the division and got it planted over an area of at least 60 acres. Nearly 3½ lacs of setts have

been distributed. Its future, no doubt, seems hopeful, but depends upon how cane area is affected in general by the prices that rule for jaggory.

J33 is another cane that has some possibilities for its spread in the Cheni area About a lac of its sets have been replanted this year in Chitaldrug and Hassan Districts. If the white sport of this variety declares itself as good as this, that will have surely a better go in the Cheni tract.

Other seedlings are being tried both on the Marthur Farm and by members of the Union in the Sagar Taluk.

Red Mauritius still continues on as the cane of the Malnad or the zone of heavy precipitation of rain.

Altogether my staff is responsible for the distribution of 9 lacs of sets as against 6 lacs given out last year.

Mills, Jaggory Boiling Demonstration, etc.—Seventy-two jaggory boiling demonstrations were held as against 42 done during the previous year. The help of the Department is sought more now for the preparation of a better class of jaggory. If prices of pans go down, the improved type of furnace and double pans system is likely to be taken up. Three sets have been sold this year in the Division and about 30 skimming ladles have also been introduced.

The clamour for genuine Nahan mills was as great as ever, hundreds of mills would have been purchased if only they were in stock at the proper time. With great difficulty I got only 24 mills from the Punjab of which 4 arrived in broken condition.

These together with the remnant of last year's supply were sold within a very short time and the total number came up to only 29 as against 34 in the previous year. The special feature in this year is that we have tackled the Hassan and Kadur Districts where owing to the prevelance of the contract system the improvement in milling operation is beset with extreme difficulty.

A small power mill was tried at Kalenahalli, Chennarayapatna Taluk, with some success. If the engine had given no trouble and the work had gone on more regularly the plant would have aroused a greater sympathy from the raiyats. It was universally admitted that it gave a bigger extraction than the ordinary mill. Even with the Cheni its capacity was half a ton per hour. It is almost idle to depend upon the financial results of a concern that worked only in fits and starts. I am fully convinced that small power plants are bound to succeed and have full chance introduction.

Ground-nut.—This is another important crop to which special attention has been paid by us. The Department is merely doing propaganda work while most of the seed is being supplied by inter-distribution among raiyats themselves. Two hundred and thirteen maunds however went out of the portals of our Depots. The short seasoned type of Spanish and Small Japan being always successful, have tended to the rapid increase in the area of groundnut itself. Spanish peanut has now spread to more than 8,000 acres in the Davangere Taluk where a second crop of jola is taken on the same land in theself same season. In the remainder of the Division it at least occupies another 2,000 acres. The special centres where it is found in abundance are:—Davangere, Chennagiri, Honnali, Shikarpur, Sorab, Tarikere, (especially near Ajjampur through the influence of Mr. Ramachandra Vasudeva Rao) Kadur and Arsikere.

Strenous efforts are being made to take it to the Malnad where the crop is found to flourish well. Unfortunately due to the extreme indifference that is received by dry cultivation in general, it has not had fair treatment at the hands of the paddy-loving malnad raiyat. Anyhow, the crop has immense possibilities, and unflagging attempts have to be made, and will be made, to push it on as much as possible.

A just complaint is hurled against these varieties that they are not nearly as good yielders as the trailing ones. It devolves on the Botanical section to now hand us a variety that will combine in it all the good qualities, *viz.*, maturing early, yielding high and growing erect. I understand that Mr. Badami has evolved one already, and if he can spare us some of it, the same will be tried most carefully not only on the Marthur Farm but in different areas of my Division under different conditions. The trailing varieties, though they may yield as high as they ever can,

will never enlist the same amount of sympathy as the erect one, on account of the heavy cost that is entailed in harvesting them.

I may, in passing, mention that superphosphate was tried on groundnut to see if the yield could be thereby enhanced. The growth was excellent and the pods looked bigger and more numerous. Unfortunately, the gentleman on whose lands the experiment was tried, mixed up both the treated and untreated crop before weighing. The results could not thus be gauged accurately. A fresh trial on a better and surer basis will be made in the monsoon of 1923.

Paddy.—Several varieties, *viz.*, Halubbalu, Chintamani Sanna, Alur Sanna and Banku Paddy, were distributed and aggregated to 11,251 seers. Halubbalu alone had 9,818 seers to its share. This paddy is becoming popular even in the Malnad where, to be successful, it has to be sown rather late in July or early in August. It has again been introduced in the westernmost parts of the Nagar and Sagar Taluks for trial as a summer crop. Our thanks are due to the District Board of Shimoga for granting Rs. 50 for meeting the heavy charges of transport of seed to these distant places. The Department is responsible for extending this crop over an additional 500 acres. Coming to others, we have sold 735 seers of Chintamani Sanna, 600 of Alur Sanna and 98 of Banku.

Economic Transplantation.—The precept of the Department and the example of the more enlightened cultivators have changed the very mentality of the paddy growers. Dibbling in of 40's and 50's has almost become a thing of the past and given place to the practice of using ten. Even in the Nala area economy in the number of seedlings used is gradually stepping in. The rate of 80 seers to the acre has been replaced by 30 to 40 seers. Real economic transplantation of using 2's is in vogue in more than 2,000 acres at least, and that in the heart of the Malnad. The future of our work in this line looks extremely bright.

Ragi.—Five thousand two hundred and forty-six seers of H. 22 ragi were distributed as against 1,624 seers given out in the previous period. More than 500 acres were undoubtedly under it in the Western Division. Except in places where it was seriously affected by drought, it showed itself superior to the local variety in all the others' fields. Mr. Ramachandra Vasudeva Rao took special trouble to experiment it on a large scale with the local types, and here, as everywhere else, it asserted itself. Our special thanks are due to this gentleman as he has taken great care to keep the seed pure, and sold all his produce for the benefit of his brethren. Large quantities of seed have been preserved by the raiyats themselves and a very large extension of this area is in prospect.

Unfortunately this ragi is one that matures a bit late and possesses the danger of suffering seriously if late rains fail. Attempts should be made to evolve a variety that has a shorter lease of life.

Nati-ragi.—Nati-ragi was taken to Shikarpur and Shimoga Taluks for trial on paddy plots, but as ill luck would have it, it either suffered from excess of rain or prolonged drought and fared as bad as possible. I am anyhow getting a few more pallas and shall make another attempt.

M. M. 1 or the Malnad Ragi was grown with great success in several places. One hundred and twenty-five seers of it were supplied, but as it was really sown only in a few places, not more than 600 seers of it are available for seed out of this year's produce. Of course, the people that tried it this year will again take it up and sow it on a large area. The variety is markedly famous for its number of spiklets. Ten to 12 were very common and in one earhead upto 20 were counted. This type is again a late maturer and has its concomitant disadvantages.

The other varieties of ragi tried have not yielded very good results on account of bad seasonal conditions. On the Hassan demonstration plot, however, H. 2 did better than H. 22. The seed of H. 2 has been carefully preserved for its trial on a large scale this year.

Wheat.—The Bijapur or the Duram type of wheat has almost established itself around Chikmagalur. At least 200 acres of it are being grown for the last two years. As this was being attacked by rust when irrigated, Pusa 4 and Pusa 12 which were supposed to be rustproof were tried at several places in the Division. The varieties grew well and were found comparatively immune to rust. Unfortunately not much seed could be saved, more on account of the gross negligence of the growers. More seed will be imported again and tried in a more careful manner.

Cotton.—Sixty-six maunds of Selection No. 69 were distributed in several places in Chitaldrug and Davangere Ranges. It covered roughly 300 acres. It is assuredly a great improvement over the local type. Its cotton is pure white and longer stapled. All those that grew it want to reserve the seed for their own sowing next year. The season was remarkably bad for cotton and any comparison of its yields with those of local *sannahatti* would not be very fair this time. Upto the time of writing this report, 166 maunds of seed have been distributed by the Department over and above what has been taken up by the raiyats themselves by inter-distribution. It is expected that another 100 maunds at least will be worked in before the cotton sowing season is over. I am tolerably certain that even making an extra cautious estimate this improved strain of cotton will spread to at least 200 acres in the agricultural season of 1923. In the Molkalmuru Taluk where the black seeded inferior nadam cotton was being grown hither to the influence of the Madras Agricultural Department has slowly crept in, and it is pleasing to note that on nearly 4,000 acres here the improved type of H. 25 of Bellary has replaced the inferior type. This type though infinitely superior to the local nadam and a high yielder to boot, does not possess nearly as good a ginning percentage as our Selection 69 of Hiriyur. Thus 50 lbs. of the latter were taken and distributed to two respectable men in the area for trial against H. 25. When I went to Dharwar I found that Dharwar No. 1 selected and distributed largely there by the Department was also a very good type of cotton. I have thus imported about 12 lbs. of this or a quantity sufficient for 2 acres, and shall see how it will compare with our Selection 69. If the performance of 69 continues unaltered as we expect, we have to scrupulously collect and commandeer all the seed from the two thousand acres on which it is likely to be sown this year. This is the only sure way of the rapid and sudden increase of the area under the crop. It will multiply twenty fold and may possibly cover 40,000 acres next year. Again, the indiscriminate mixing has to be prevented at this initial stage, and this can only be done by Government agency. The organisation of a special staff thus seems urgent.

Pepper.—Ten thousand cuttings were got last year of which a large proportion was damaged during transit and even a good portion of these that reached the destination safe were planted at once. Thus the percentage of those that really struck root may not be more than 10. There has again arisen a big demand for these cuttings and 15,400 cuttings have been imported and distributed.

Manures.—Huge quantities of oilcakes are being imported and used on all crops especially, coffee, sugarcane, paddy, etc. Though over 90 tons were got through the Department more than 4 times as much must have been used through the indirect influence of the department. One village near Hassan has all alone taken up 30 tons at the instance of the Inspector. Its illimitable use by the coffee planters is too well known to need any repetition here.

Superphosphate.—The use of this valuable manure has been very successful especially on the alkaline soil of the Hiriyur, Challakere and Molkalmuru Taluks. The results got by its use are tabulated below. (*Vide* list appended).

Superphosphate has also acted beneficially on cane on the Marthur Farm and on some raiyats' fields. The growth has been better and the tillerings more profuse. How it will act on the final yields will be reported after the harvests are over. The effect of superphosphate on green manure is worthy of special note. The growth of the green leaf is both hastened and forced by it. The results of experiments tried on the Marthur Farm are reported in a separate paper which will probably be published in the Journal.

The work of green manuring will hereafter be simplified and will be possible in greater number of cases than now by the application of supers.

Twenty tons of supers and ten tons of bonemeal have been supplied through the department.

Several tons of oilcake have been taken for areca especially in the maidan where the trees are systematically irrigated. This, along with supers, is solely coming to use for areca.

Ammonium Sulphate.—This highly concentrated nitrogenous manure is attracting the attention of the cane growers. As the beneficial effects of its application became markedly visible in a very short time, it is the most convincing manure

going. Mr. Kalle Gowda of Nandipur has used it for coffee and says the results are very encouraging. We have distributed 718 maunds of this fertiliser.

Green Manure.—This work has also progressed somewhat in my Division. The Engineering Department kindly let in water into the Cuavery channels near Ramanathpur. More than 2,000 acres were at once sown with sunn-hemp for green manuring paddy. The benefits accruing from this improvement are certainly immense. In the Nala area of Marikanive nearly 100 acres had again this crop. The Hassan District Board came to our aid by advancing Rs. 1,000 for the purchase of green manure seed. Letting alone what we had been distributing before July, the quantity actually sold in the present official year has been 7,545 seers. The District Board has again joined hands with us and lent us Rs. 2,000 for buying the seed.

It is also admitted on all hands that the variety of sunn-hemp we have taken from Bombay is certainly better than the local types and produces a more vigorous plant in a shorter time. But the raiyat as usual is certainly unwilling to pay more for it.

All possible efforts are being made to convey this improvement to every nook and corner.

It had been found beyond any vestige of doubt that the growing of green manure for paddy is certainly feasible in the malnad. The straying of cattle which is the besetting curse of the malnad is the greatest obstruction in our way. The putting in of the crop suddenly on a large area is not a practical proposition without the aid of a convincing first experiment. Any small patch devoted to it will be the surest victim to the cattle that roam about without let or hindrance. It is thus a problem that baffles the ingenuity of the most skillful propagandist. Some of our co-operators have after much persuasion consented to try it and have actually sown the green manure. To add to our difficulty rain usually held off too long just at the sowing time and came in torrents after it once began.

Green manure, especially cowpea, sown in the areca garden at Marthur promises very fruitful results. Mr. Chayapathi has already begun his maiden trials on raiyats' fields at Sagar. The far reaching benefit of this improvement, if only successful cannot be overestimated. Anyhow, there is strong hope before it and it is one of the future problems that will have to be attacked vigorously by the Department. Growing of green manure between the lines of cane is another improvement that stands a chance of sure success. The application of super, as I have already said, acts wonderfully on its growth and cowpea treated with it on the Marthur Farm has produced incomparably more growth of leaf than the one that did not receive the manure. Even the ordinary cowpea found in the bazaar will quite do. My belief is that green manure with supers, burnt earth, a small dose of cake and a small quantity of cattle manure will probably be the most economical recipe for manuring cane. A rough experiment tried by a co-operator of Nagar has given the following results.

Plots	Manures used	Tonnage per acre
Check I ...	50 cart-loads of cattle manure per acre	27 tons
	Oilcake 40 mds. per acre, cattle manure 10 cart-loads per acre	32 tons
Check II ...	Only 80 mds. of oilcake and no cattle manure ...	29½ tons
Check III ...	Green manure 4,000 lbs. per acre; *Sudamannu* 10 cartloads, cattle manure 20 cart-loads; oilcake 10 maunds per acre.	32¼ tons
Check IV ...	Green manure 40,000 lbs. per acre; *Sudamannu* 10 cart-loads, cattle manure 20 cart-loads.	31½ tons

Silo Pits.—As due to continued drought, grass did not grow well and attain good height, the facilities for ensiling it were not great. Anyhow, 6 pits were filled in.

Lantana Compost.—The Inspectors have succeeded in persuading the cultivators to fill in 25 pits with Lantana leaf for making compost of it. The work, if assiduously pursued and the farmer gets convinced of its advantages, has a great future before it.

Work with the aid of Co-operative Societies.—With the help of the Department, earnest endeavours are being made to induce some Co-operative Societies to stock and sell implements, seeds and manures. Fourteen societies have responded to our preaching and the Arsikere Society has earmarked Rs. 500 for this purpose.

Miscellaneous.—We have distributed 203 packets of copper sulphate for preventing smut and sold vegetable seeds worth Rs. 214-10-0. Our total transactions excluding what we have sold by private negotiation have run up to Rs. 39,325-10-10.

Some attempts are being made to distribute jola for growing fodder and 635 seers of it were given out in the period under report.

Turmeric has also received attention and 47¾ maunds were introduced. More seed was not available to meet the demand.

Demonstration Plots.—In the compund of the Municipal Office at Hassan, the different varieties of canes, cotton, groundnut, castor and ragi were raised merely with a view to show to the ryot how they would look like. Five hundred and forty-four and 312, Red Mauritius, Java were all planted side by side with local Pattapatti and Cheni. Ammonium sulphate was used on a portion of the crop to show its effect in contrast. Though its results are of no value the crop has been the most useful advertisement and an eye opener to a very large number of men in the Hassan District. Cultivators that had no love for cane were tempted to at once rush to the crop.

Ragi, groundnut and cotton had likewise a chance to advertise themselves. Castor capsules were unfortunately raided by borers. We owe our thanks to the District Board of Hassan for helping us in organising this demonstration. They gave us a whole-time man on Rs. 12 for over two years. The second and bigger plot was started at Holenarsipur through the kindness of Mr. N. Rama Rao, the Superintendent of Sericulture. Here, Java cane was planted on one acre and soon developed into excellent crop that excited the admiration of every farmer. People rushed for its seed but wanted it cheap. With the sanction of the Director I reduced the price from Rs. 5-8-0 (which was the original figure I put upon it) to Rs. 4 for thousand setts. Altogether 41,532 double setts were distributed in areas where cane was hitherto unknown. Further distribution was stopped as the cane developed red rot owing to probably insufficiency of water. A small quantity of jaggory was also made.

Halubbalu paddy was tried and its yields were far inferior to those of the local Garuda Kembuti. I am not sure that it can vie well with the other more established varieties of the nala area. The experiments with groundnut cake, with bone-meal or supers seem to indicate the superiority of supers. The applications were purposely made too heavy with a view to see what doses would be economically advantageous. The doses are by no means economical. The results are tabulated below:—

AREA OF 25 GUNTAS.

No.	Nature of experiment	Dose per acre	Area of plots in guntas	Per acre
1	Groundnut cake	200 lbs.	4¾	1,568 lbs.
	Bone meal	200 „		
2	Groundnut cake	400 „	4½	1,618 „
	Supers	400 „		
3	Groundnut cake	600 „	2½	1,088 „
	Bone meal	600 „		
4	Groundnut cake	600 „	2⅛	1,754 „
	Supers	600 „		

The financial statements are also appended. These indicate that we have made money in sugarcane though we have had to spend more than Rs. 72 for watch and ward alone. The high cost of the fertilisers used and that of watching the plot which has summed up to Rs. 45 have made us incur loss from our paddy. It is the evil that always accompanies the employment of small plots for experiments. We have earned Rs. 26 from vegetables.

I must thank the several District Boards that have stretched a helping hand to us. Hassan which has done most for us gave a whole-time servant for our demonstration plot. They have further advanced another Rs. 2,000 for the purchase of seed. They have sanctioned Rs. 100 for the purchase of implements which are kept for hire.

The Shimoga Board have advanced Rs. 750 of which Rs. 50 have been sanctioned for meeting the freight on paddy sent to the corners of Sagar and Nagar Taluks. They also bore the charges of printing the leaflet on Lantana Compost. The Kadur District Board have followed the footsteps of Hassan and kindly lent us Rs. 2,000.

D. G. RAMACHANDRA RAO,
Assistant Director, Shimoga.

APPENDIX I.

Sugarcane—Area one acre.

Items of expenditure	Rs.	a.	p.	Items of receipts	Rs.	a.	p.
1. Preparatory cultivation such as removing the stubbles of mulberry, ploughing, levelling, etc.	21	10	0	1. Sale of setts	297	7	9
2. Making pits	8	0	0	2. Thirty-two maunds of Jaggory at Rs. 2 a maund	64	0	0
3. Planting	6	2	0	3. Sale of setts outstanding	25	0	0
4. Weeding	5	4	0				
5. Cost of city manure	10	8	0				
6. Slaughter-house refuse and cost of spreading manures	6	4	0				
7. Bamboos for propping	11	0	0				
8. Cost of propping and applying fertilisers	4	3	0				
9. Cost of fertilisers	60	0	0				
10. Value of sets	40	1	3				
11. Milling charges, etc.	58	0	0				
12. Watching	72	0	0				
Total	303	0	3	Total	386	7	9

APPENDIX. II.

Paddy—Area 25 guntas or 5/8 acre.

Items of expenditure	Rs.	a.	p	Items of receipts	Rs.	a.	p.
1. Ploughing, etc.	10	0	0	Halubbalu paddy sold	5	14	0
2. Manure and spreading	4	14	11	253 seers paddy at Rs. 7 per palla	15	2	0
3. Fertilisers and spreading	11	0	0	Garudakembuthi			
4. Transplanting	0	15	0	528 seers at Rs. 7 per palla	36	15	5
5. Weeding and tying sheaves	1	8	0	Straw	11	0	0
6. Harvesting and threshing	1	8	0				
7. Seeds	2	0	0				
8. Watching	45	0	0				
Total	76	13	11	Total	68	15	5

APPENDIX III—Vegetables.

Items of expenditure	Rs.	a.	p.	Items of receipts	Rs.	a.	p.
Preparation of land, etc. ..	7	14	0	Value of produce upto date ..	61	7	0
Watering	27	0	0				
Total ..	34	14	0	Total ..	61	7	0

APPENDIX IV—Abstract.

Items of expenditure	Rs.	a.	p.	Items of receipts	Rs.	a.	p.
1. Sugarcane	303	0	3	Sugarcane	361	7	9
2. Paddy	76	13	11	Paddy	68	15	5
3. Vegetables	34	14	0	Vegetables	61	7	0
				Total ..	491	14	2
				Sugarcane setts	25	0	0
Total ..	414	12	2	C. Total receipts ..	516	14	2

Taluk	Manures used	Area	Yield		Cost of manures	Profit	
			Kind	Amount			
		Acre.	Pallas.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Hiriyur, Marikanve.	16 mds. of supers ..	$1\frac{3}{4}$	22	220 0 0	48 8 0	171 8 0	
	14 mds. of G. nut cake ..						
	20 cart loads of cattle manure sunnhemp.	$1\frac{3}{4}$	12	120 0 0	20 0 0	100 0 0	
						71 8 0	Increased yield or
						42 12 0	per acre.
Do, Byadrahalli	8 mds. of supers ...	1	12	120 0 0	15 0 0	105 0 0	
	Sunnhemp and cattle-manure.	1	8	80 0 0	10 0 0	70 0 0	
						35 0 0	increased income per acre.
Challakere, Nidupankunte.	8 mds of supers and cattle manure.	1	25	15 0 0	185 0 0		Cattle manure being common to both has been left out.
	Mere cattle manure ...	1	16	...	128 0 0		Increased income per acre
					57 0 0		

Annual Report of Live Stock Section 1922-23.

During the year a total number of 190 days were spent on tour, and all tricts visited with the exception of Shimoga and Kadur.

Office.—The inward and outward correspondence numbered 3,637 and respectively, being an increase of 400 and 580 over that of the previous year clerical staff has remained unchanged.

General.—District Conferences were attended at Bangalore, Kolar, and I also attended District Board Meetings at Kolar, Chitaldru Mysore, Hassan and Bangalore, the regular meetings of the Board of Ag till they were discontinued, and the Amrut Mahal Sub-Committee and some he sales of Amrut Mahal cattle. The usual classes were held at Hebbal Ag ultural School and lectures given to second and third year students.

Draught Cattle.—Actually very little has been done to further this work during the current year. The bulls maintained in conjunction with the District Boards have been increased by five and one buffalo-bull, and the number of coverings per bull has shown some improvement. This is more fully reported on in the report of the Civil Veterinary Department. A few bulls were obtained for clients unable to secure good animals for themselves and subventions granted for the maintenance of breeding bulls in three cases. A fairly comprehensive scheme for the advancement of this work by a re-organisation of part of the Amrut Mahal Department has been prepared, and it is expected that early orders will be passed on this, which, if put into effect, should go some distance towards increasing the availability of good breeding animals and stimulating an interest in the industry.

Rayankere (Palace) Dairy Farm.—As heretofore, the management of the Rayankere Dairy Farm has through the graciousness of His Highness the Maharaja of Mysore, been entrusted to this section. The herd has increased slightly in numbers due to natural increase, though the actual number of cows has been reduced. The total number of animals (not including work stock) is 136, of which 93 are cows. Details may be found in a statement attached (Appendix I). Twenty-six cows and thirty-four calves of both sexes were sold during the year and two cows transferred to the Palace Karohatti Department. The cows were sold as not being sufficiently high producers to be worth keeping in the herd. During the year 3 cows, 2 yearlings, 16 calves and 1 bull, sent to the Farm from the Palace Herd at Ooty, died. Of these, six were due to Black quarter, the remainder being due to accidental and non-contagious diseases. A disquieting feature of the year has been the occurrence of nine abortions and premature births. Evidence points to the probability of this being due to a contagious cause, as all cases occurred in cows that had previously suffered from mammitis or udder trouble of a similar kind. Steps have been taken to reduce the occurrence of this trouble. Unfortunately, isolation facilities are not yet of a satisfactory nature, but it is expected that some suitable buildings will be erected during the coming year, and that these will make a decided improvement in this direction. The foregoing influences have all tended to reduce the average yield of the herd. In addition due to the fact that in December 1921, breeding operations were stopped pending the arrival of the Holstein bulls for several months during the year under review, no calvings took place and the percentage of the herd in milk fell to as low as 33 per cent for a few weeks. Notwithstanding, the herd average milk production has slightly exceeded the figure of last year, being 4·2 lbs. per capita per diem. The low average is in part due to the fact that a number of cows were still retained in the herd to be proved, some of which have not turned out to be good producers. The process of discarding low producers must of necessity be governed by the possibility of replacement by better animals. The difficulty of securing high producing animals automatically sets the standard up to which individual animals must measure as a low one. A marked improvement in production will only be possible, after the young stock now on the farm have reached maturity. Another factor conducive to low production is the presence of Hallikar cows in the herd. These animals have a legitimate place in a herd of this nature, but are on the average lower producers, slower breeders, and are dry for a greater length of time. The average dry period of all the Sind cows in the herd taken

over in some cases a number of years averages 201 days. The average for the Hallikar cows over the last two years is 297 days. Of the Sind herd 45 per cent were in milk through the year, and the Hallikars 41 per cent were in milk.

In November 1922 the first-half bred Holstein calves were born. Up till the end of the year, 34 heifers, and 26 bull calves were born and are very promising for the most part. They have shown, as was to be expected, greater birth weights than anything born on the farm heretofore, being on an average 5 lbs. heavier than the Ayrshire half breds born on the Farm. The following figures show the birth weights of the different breeds. The fact that in the case of both Holstein and Ayrshire half-breds the heifers average a higher weight than the bulls is of passing interest.

	Heifers	Bulls
	lbs.	lbs.
Sindi	41·5	44·4
Hallikar	48·1	48·2
Ayrshire X Sind 1st cross	47·3	43·8
Holstein 1st cross on all breeds	53·4	48·5

In January 1923, a third young Holstein bull was imported and stationed on the Farm. This animal which was specially selected on account of his breeding, is designed for breeding to the present half breds, for which his breeding fits him uniquely. He is withal a very good specimen of the breed. One hundred and thirty-three coverings have been made by those bulls during the year. This includes cows which have calved and been re-covered during the year, heifers which though covered have not yet been taken on to the cow roll, and repeat cases. Thirteen coverings were also made by the Sind bulls. In order that the Sind herd may be kept up, a larger number of pure Sind matings will be made during the coming year. This will be necessary in order that the foundation stock for the production of half-breds may not be allowed to fall too low.

Feeding experiments.—The feeding experiments with calves carried on in co-operation with the Chemical Section and reported in the last year's report have been carried on, The first lot of 20 calves (yearlings) were held under experiment until bred and additional experiments set up as the animals became available. Final results of the first and preliminary reports on the successive experiments have been published elsewhere. The object of these experiments have been to obtain data on the most suitable feeds, mixtures and amounts as growing ration for young stock. Some useful information has been obtained, but more conclusive evidence is necessary before definite conclusions can be drawn and published as such.

In addition to experiments with calves, a three months' experiment was set up to test various feeds for their milk producing qualities. The results of this experiment were not of a very definite nature, and need verification by further experiments to be conducted during the coming year.

Farm Section.—The rainfall during the year was 26 inches and 56 cents The year was unusual in that the distribution was very general. Good rains fell in March and April 1923, which made a good early crop possible. This crop however has its effect during the ensuing year. On the whole the crops grown during the year were good and nearly 1,000 tons of ensilage were grown and cured. The area under cultivation was increased to 100 acres, while nearly 200 acres were cleared of jungle growth preparatory to being brought under cultivation in the next 2 or 3 years. A reserve of fodder over the requirements of the year has been made to the extent of about 250 tons of ensilage and 30 tons of hay. Approximately 35 tons of hay were supplied to the Palace Body-Guards and sold to outside customers, and about 200 tons of reed grass supplied to Palace Gajasala. The main crops were jola and cowpea and sunnflower. Velvet-bean was introduced as an experimental measure and promises to be a crop of some value.

Implements.—The addition of implements and equipment was a large one. Chief among these were a Ransomes two furrow tractor plough, one 6 H. P. International Engine and Chaffcutter, one McCormick mowing machine, a five ton weighbridge and one 2½ H. P. Petters engine and pump, to replace the pumping plant which was in use before on loan from the Public Works Department. The mowing machine

which is used to supplement one previously on the farm, has proved to be of signal use, all crops but grass in places where their use was impossible were cut with the help of these machines.

Other improvements consist of road making, planting over 100 shade trees in the cattle yard and on roads, the construction of two large trench silos and the clearing of land already alluded to.

The Farm has been under the charge of Mr. B. Lakshmipathi Naidu, G.B.V.C., throughout the year. The interest taken by this officer in the work, and attention shown by him to its proper execution has been very largely instrumental in the satisfactory development of the Farm and the herd and is well worthy of mention.

Hebbal Dairy.—During the year, the Dairy was in the charge of Mr. C. Narasinga Raju, who supervised the work in addition to his regular duties as teacher in the Agricultural School. The Dairy Inspector R. Narayana Iyer was transferred to Rayankere Dairy Farm on 29th August 1922, and the duties taken over by Mr. N. S. Rangaswami. The latter having left the service on 28th January 1923, the work of the Dairy was assumed by Mr. D. Srikantiah, the Agricultural Inspector in charge of Sheep Farm, Hebbal, who is now combining both duties.

Mr. Narasinga Raju was deputed to Bombay to take delivery of a Holstein bull in January 1923.

Inward and outward correspondence numbered 296 and 979 respectively,

The main lines of work have remained much as in the previous year. The strength of the herd was 39 (*Vide* Appendix No. II.) of which 71 per cent was the stock raised on the Farm, and 33 per cent of the cows on the roll were Farm bred. The herd was sired by one bull the progeny of cow Tara No. 4.

There were 24 coverings and 14 calvings during the year, the percentage of calving to covering being 58. In addition to the farm bull, 2 bulls were kept for public service. They served 167 private cows, which is 21 per cent more than the number of cows served last year. The bulls kept for the public have been increasingly popular.

Throughout the year there were 10 cows in milk. The average yield over all the cows per head per day was 4·4 which is ·4 less than in the previous year. The performance of the herd is tabulated in Appendix No. III. There were 14 births and 5 deaths. The mortality was chiefly in young stock. The general health of the cattle was good. About the middle of the year a severe form of skin disease broke out among the calves, which set back their growth a good deal. All the young stock were inoculated against Black quarter.

Production and disposal of dairy products are tabulated in Appendix No. IV. Dairy products to the value of Rs. 1,536-3-3, chiefly as butter and whole milk, were sold.

Ensilage was the only kind of roughage used. Nearly 150 tons of green fodder were converted into ensilage in cylindrical and trench silos. The loss over all the silos was 17 per cent. The cost of preparing the ensilage was Rs. 14-7-4 a ton. (*Vide* Appendix V.) One of the trench silos was lined with Cuddapa slabs at a cost of about Rs. 375.

5·8 acres at the disposal of the Dairy were under fodder crops; jola, sunnflower, velvet-beans, cowpea and sunnhemp. Out of the total area under fodder crops 3·5 acres were sown with sunn-flower, the average yield being 5½ tons per acre. About 2½ acres of this crop were allowed for seed. The average yield of seed per acre was 322 lbs. To provide the calves with green herbage 1·6 acres were laid under a mixture of cowpea, velvet beans, sunnhemp and sunnflower. The calves were allowed to graze when the crop was about 1½ months old. This furnished good grazing for nearly 2 months for about 10 calves a day on an average. The stubbles left over were ploughed under. Two hundred and forty lbs. of sunnflower seed were distributed for trial in the districts.

Veterinary Hospital, Hebbal.—The hospital was in the charge of Mr. C. Narayana Iyengar loaned from the Civil Veterinary Department until 1st January 1923 when charge was assumed by Mr. P. S. Shama Rao.

The usual teaching work was carried on in addition to the work of the Hospital and 223 lectures delivered. The campaign of castration in neighbouring villages was continued during the spare time of the Veterinary Inspector and 138 castrations performed. Outbreaks of Anthrax, Blackquarter and Rinderpest in the surrounding villages were also attended to, and 573 animals inoculated.

In the hospital 784 cases were treated, as detailed below:—

Statement showing the number of animals treated under different diseases in the Hospital and the outdoor work turned out.

424	Cattle	Class of animals.
3	Horses	
342	Sheep and Goats	
13	Dogs	
2	Other animals	
784	Total	
10	Specific	Class of disease.
210	Digestive	
30	Respiratory	
15	Circulatory	
136	Surgical	
381	Ordinary	
784	Total	
138	.. ..	Number castrated.
573	.. ..	No. inoculated.
20	... .	No. of calves inspected.
455	... ...	Government Farm.
329	... ...	Villagers.

Sheep Farms.—Sheep are being maintained at Hebbal as well as at the Farm in Yellachihalli. For different reasons connected with the experimental nature of the work, transfers of sheep from one farm to the other are advisable from time to time. The strength statement of the sheep is therefore given in composite form and no attempt made to differentiate the flocks of the two farms. The total strength is now 462, of which 287 are ewes, and 5 Merino rams.

Seven Merino rams were imported from Australia during the year, of which two died, the others being in good health and now used for breeding. Ninety-five ewes have been covered during the current breeding season. The attempt to establish a definite breeding season instead of an all year round breeding is being continued. The lambs born in October, November and December seem to do better than those born later, and the ewes to lamb with a heavier flow of milk at that season. This observation however only covers one year, and therefore cannot be accepted without further observations. The lambing season during the year was a fairly successful one, 140 Merino hybrid and 19 country lambs were born. The mortality among lambs was 26 in all. Five three-fourth bred Merino lambs were born, and the improvement in wool over the half breds is very noticeable. Although these five were all born strong and did well at first, 3 died later in the season, the other two appearing to be strong and healthy animals. The multiplication of three-fourth bred lambs on a larger scale should be productive of some interesting results, and this will be done when more half bred ewes are available. The growth of the half bred lambs has been good throughout, and an average of between 2 and 3 ounces of increase made daily, which is almost double that made by country lambs.

The flock of ewes has been added to by the purchase of 153 local ewes and 52 ewes purchased from Poona. These latter show a better fleece than the Mysore sheep and were obtained on that account.

To partly supply a strong demand for sound breeding ewes, 100 such were sold to the Kolar Sheep Breeders' Association and seven half bred rams were distributed for breeding purposes. It is hoped that a much bigger supply of the latter will be available during the coming year, and that it will be possible to more nearly supply the demand than was possible last year.

The sheep were clipped in February. The average yields of wool were,

Merino rams	11½ lbs.
Country ewes	1 lb.
One-fourth bred ewes	1¼ lbs.
Half bred ewes	1¾ lbs.

The average yield of the country ewes shows an increase of 2 ounces over that of last year, due possibly to a closer selection, but the average of the half breds shows a decrease. It is noticeable that as the ewes increase in age their wool yield becomes reduced, and the explanation for a lower yield may lie in this fact, as the animals clipped shew a higher percentage of old animals than heretofore.

Yellachihalli Farm.—The farm at Yellachihalli has been improved by the clearing of a large area of lantana and scrub and about 8 acres of new land brought

under cultivation. Ensilage was made from crops grown on the cultivated land, and used to feed the sheep during the hot weather, with satisfactory results. Owing to the lack of funds, the buildings erected on the Farm in 1921 were of a temporary nature, and in May it was necessary to remove the roof of one pen for re-erection. The funds available still render it impossible for a pukka roof to be erected. Moreover the buildings are far from adequate, and not more than half enough accommodation is available for sheep and none for the men or Inspector in charge. An increase in the number of sheep maintained and in the scope of the work is impossible until extra buildings are provided. It is to be hoped that next year at least, more money will be made available for this necessary development.

The demonstration of improved methods of clipping and dipping sheep has been carried on in the Kolar District. Owing to the lack of staff it has been impossible to spread this work over a larger area. Government have since sanctioned the entertainment of an additional Agricultural Inspector and fieldman for this purpose, and it is hoped that a larger territory can be covered in future. This work has been favourably received at the hands of the sheep breeders of the District and during the year, 620 sheep were clipped and 3,404 sheep dipped, in 23 villages. Coupled with this demonstration work has been propaganda to awake an interest in the maintenance of the better class of sheep and better methods of husbandry. To make the organization of this work more easy it was decided to form an association of sheep breeders, and the Kolar Sheep Breeders' Association was organised in consequence. This Association held its first meeting at Kolar in January with 25 members, and elected the President, District Board, as Honorary President. The membership at the end of the year was 70. A total number of 150 white ewes of a good stamp, some of which had been bred to Merino rams were sold to members during the year, and several half bred rams distributed. The demand has very much exceeded the supply, but it is hoped that the situation will be relieved during the next year, and that more animals, especially rams, will be available from the Sheep Farm to meet the demand. An indication of the interest taken in sheep breeding in Kolar District, is the dicision of the Kolar District Board to maintain a Merino ram of their own in connection with the flock already kept by them. The Board has been very sympathetic in its attitude towards the sheep breeding work, and my thanks are due to them for the valuable help they have rendered in furthering it.

W. DAVISON,
Live Stock Expert.

APPENDIX No. I.

Cattle Strength Statement of Rayankere Dairy Farm.

	Strength on 1st July 1922	Strength on 30th June 1923
Cows—		
Sindi	84	70
Hallikar	17	17
Mixed	4	4
Half-bred	2	2
Bulls—		
Sindi	3	3
Holstein	2	3
Calves—		
Sind Heifer	48	41
Sind Bull	33	15
Hallikar Heifer	4	...
Hallikar Bull	10	...
Ayrshire Half-bred—		
Heifer	11	15
Bull	13	7
Holstein Half-bred—		
Heifer	0	30
Bull	0	19
Mixed—		
Heifer	0	7
Bull	0	3
Total	231	234

	Rs.
Value of all cattle on 1st July 1922	18,338
Do 30th June 1923	21,427
Net increase in value	3,089

APPENDIX No. II.

Hebbal Dairy Herd Strength Statement 1922-23.

Class of Stock	Strength on 1st July 1922	Increase			Decrease			Strength on 1st July 1923
		Births	Purchase	Transfers	Deaths	Sales	Transfers	
Cows	12	...	1	1	1	1	...	12
She-Buffaloes	4	..	...	..	..	2	..	2
Young Stock—Heifers	11	4	1	..	3	...	1	12
Young Stock—Bulls	9	10	..	..	..	5	2	12
Bulls	3	..	..	2	..	2	2	1
Buffalo-bulls	..	..	..	2	1	1	...	...
Total	39	14	2	5	5	11	5	39

APPENDIX No. III.

Dairy Herd performance.

Registered No.	Name	In the cost roll	Date of calving	Sex of calf	Yield during lactation	Average over all lactation	Yield per diem 1st to last calving	Progeny on hand	Remarks
1	2	3	4	5	6	7	8	9	10
		Yrs. Mon.							
1	Laxmi ...		18-10-15	Bull	1,335	1,606	4·4	2 Heifers (1 milking No. 18.)	Sold.
			5-4-17	do	2,148	...	...		
			5-4-18	Heifer	2,152	...	...		
			13-8-19	do	1,967	...	...		
			19-7-20	do	1,858	...	...		
			12-7-21	Bull	1,328	...	...		
			24-6-22	Heifer	454	...	...		
2	Ranee ...	7—7	3-8-15	do	3,058	2,597	5·7	3 Heifers (2 milking 2 and 16).	
			29-1-17	do	3,140	...	...		
			13-2-18	Bull	2,127	...	...	1 Bull.	
			25-12-19	do	3,537	...	...		
			27-6 21	Heifer	2,248	...	...		
			26-6-22	do	1,472	...	...		Yield to the end of June 1923.
			9-5-23	Bull	529	...	...		
4	Tara ...	7—0	7-5-16	do	2,202	1,827	4·3	.....	
			6-7-17	do	2,711	...	...		Calf died during less lactation.
			29-8-18	Heifer	24	...	...		
			15-11-19	Bull	2,696	...	...		
			2-3-21	do	1,771	...	..		
			17-1-22	do	1,557	...	...		
5	Seetha ...	5—8	3-8-17	Heifer	2,165	2,305	4·3	4 Heifers (2 Heifers milking No. 15 and 28).	
			11-1-20	do	2,722	...	...	1 Bull.	
			15-6-21	do	2,597	...	...		
			10-6-22	do	1,737	...	...		Yield to the end of June 1923.
			10-6-23	Bull	221	...	...		
6	Sundari ...	5—3	2-2-18	do	1.874	1,668	4·6	1 Heifer.	
			14-7 19	do	2,291	...	...	1 Bull.	
			7-7-20	do	1,687	...	...		
			15-6-21	Heifer	1,667	...	...		
			28-6-22	do	821	...	...		
			21-5-23	Bull	402	...	...		Calf died during this lactation, on 2nd September 1923. Yield to the end of June 1923.
	Saraswati (Ranee)	4—5	1-12-18	Heifer	2,226	1,749	4·8	1 Bull.	Cow died on 16th June 1623.
7			20-11-19	Bull	1,616	...	...	1 Heifer.	
			1-11-20	Heifer	1,652	...	...		
			7-12-21	Bull	1,497	..	...		
			20-11-22	do	1,755	...	...		
	Yamuna ...	3—0	...	do	291	1,848	5·8	1 Heifer.	
10			6-10-20	do	3,051	...	...		Yield to the end of June 1923.
			8-11-21	do	2,202	...	...		
			7-1-23	Heifer	1,516	...	...		
15	Suseela (Seetha)...	2—8	13-10-22	Bull	2,723	...	...	1 Bull.	
	Ahalya (Ranee)...	2—8	8-7-21	do	1,429	1,365	3·7	1 Bull.	
16			28-7-22	do	1,302	...	..	1 Heifer.	
			9-6-23	Heifer	244	...	...		do
	Rukmani-Radha	2—10	8-5-21	Bull	1,300	1,157	2·7	1 Bull.	
17			18-8-22	do	1,015	...	...		
	Meenakshi-Laxmi	2—2	4-1-22	do	1,460	1.378	3·7	do	
18			31-1-23	do	1,296	...	...		
	Leela ...	2—4	5-1-21	Heifer	2,746	2,806	7·4	do	
40			28-1-22	...	2,866	...	...	2 Heifers.	
			22-1-23	...	1,500	...	...		do
	Kapila (Buffalo)...	4—5	20-11-17	Bull	5,491	61,600	4·9	1 Bull.	
14			13-8-20	Heifer	4,575	...	...		
			16-8-22	Bull	2,254	...	...		
	Mandodari, (Buffalo).	1—9	15-9-21	...	4,132	...	...	.....	
57			16-9-22	Bull	727	...	...		do

APPENDIX No. IV.—Production and disposal of Dairy products from July 1922 to the end of June 1923.

Month and year	Whole milk							Separated milk					
	Production	Sales	Colostrum	Sample	Rejected	Calves	Separated	Production	Sales	Calves	Lambs	Rabbits	Starter
	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1922													
July	2,176 4	214 0	71 0	7 0	...	524 0	1,360 4	1,236 8	...	923 8	310 0	...	...
August	2,004 0	245 0	165 8	11 0	...	255 0	1,327 8	1,202 12	...	931 12	211 0	42 0	18 0
September	1,857 6	300 0	...	9 0	4 0	449 4	1,094 14	948 8	...	781 18	78 12	60 8	32 12
October	1,964 0	256 4	58 12	4 12	...	439 4	1,205 0	1,003 4	...	820 4	115 12	62 4	5 0
November	1,967 0	232 8	70 4	6 8	...	478 8	1,179 4	1,002 6	5 0	666 10	253 4	60 8	17 0
December	2,001 12	216 0	...	9 4	...	603 0	1,173 8	991 4	5 0	505 4	406 8	62 0	12 8
1923													
January	1,846 4	243 0	122 4	13 8	...	479 12	987 12	893 8	...	556 12	183 12	62 0	31 0
February	2,021 8	154 0	51 0	7 0	33 8	730 8	1,045 8	885 4	5 0	545 0	251 4	56 0	28 0
March	1,908 0	163 0	...	2 0	...	519 8	1,223 8	1,054 0	5 0	791 0	149 8	77 8	31 0
April	1,882 12	118 12	29 0	...	...	90 0	1,150 0	990 8	7 0	863 8	...	90 0	30 0
May	1,696 12	138 0	74 0	1 0	...	284 0	1,099 12	954 8	2 8	826 0	...	85 0	31 0
June	2,145 12	112 0	140 0	0 12	...	586 0	1,286 0	1,125 0	7 8	1,057 8	...	30 0	30 0
						21 0	(rams)						
Total ...	22,871 6	2,387 8	781 12	72 0	37 8	1,519 12	14,132 14	12,227 6	37 0	9,271 10	1,954 12	687 12	266 4

Month and year	Cream				Butter			Ghee		
	Production	Purchases	Sales	Churned	Production	Sales	Melted	Production	Sales	Balance
	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.
1922										
July	110 0	...	1 6	110 5	59 6	58 0	1 6	0 12	0 12	...
August	88 12	...	1 12	89 0	47 9	47 4	...	...	...	...
September	103 0	26 5	2 2	122 15	63 13	50 14	0 13	0 8	0 8	...
October	117 11	18 5	1 10	135 12	64 14	65 3	...	...	...	...
November	123 0	38 11	1 14	15 5	81 4	78 4	3 0	2 4	2 4	...
December	126 13	26 11	2 8	152 7	81 13	83 2	...	...	...	...
1923										
January	99 2	37 4	2 10	134 9	70 2	70 9	...	...	...	...
						0 10	sample			
February	99 1	...	1 8	98 5	54 6	54 10	0 8	...	...	...
March	103 6	...	1 0	100 13	55 12	56 4	...	...	...	...
April	89 14	...	3 10	81 8	49 12	49 12	...	...	...	...
May	73 10	...	1 31	71 11	40 4	40 4	...	...	...	...
June	86 5	...	2 4	84 0	44 8	40 14	3 6	2 4	2 4	...
Total ...	1,219 10	147 4	24 3	1,331 10	713 7	704 10	9 1	5 12	5 12	...

APPENDIX No. V.

Silage Abstract. Government Dairy Farm, Hebbal.

Description of silo	Dimensions of silo	Total quantity of green fodder put in	Total quantity of silage removed	Total loss	Percentage of loss
		lbs.	lbs.	lbs.	
No. 1 Cylindrical silo ...	20′ x 10′	50,234	44,418	5,816	9·6
No. 2 „ „ ...	25′ x 10′	59,442	52,557	6,885	11·5
No. 3 „ „ ...	30′ x 12′	70,250	62,797	7,453	10·6
No. 4 Trench silo ...	60′ x 6′ x 6′	81,707	54,609	27,098	33·1
No. 5 „ „ ...	51′ x 6′ x 6′	73,459	in use		
		149 tons 1,329 lbs.			

	R.	a.	p.
Cost of preparing 1 ton of ensilage, Green fodder at 200 lbs. to a rupee	11	3	2
Chaffing and filling charges	0	14	6
	12	1	8
Loss at 17 per cent	2	5	8
Total cost ...	14	7	4

Report of the Engineering Section for 1922-23.

During the year under report, my time was given to the following.—

1. Gathering results of the trials of the Improved Plough manufactured at the Railway Workshops.
2. Manufacturing a few cultivators, plough parts, and other small implements.
3. Trial of a few new implements at the Hebbal Farm.
4. Building works of the Department.
5. The Engineering instructions at the Hebbal Agricultural School.
6. Management of the Farm Workshops.
7. Despatch of the engine outfits to places where they were in requisition
8. Transport of materials through the lorry.

I was on tour for 55 days in the year, the touring work of the staff being as follows:—

1.	Draftsman	.. 7 days.
2.	Mechanic	.. 59 ,,
3.	Carpenter	.. 19 ,,
4.	Smith	.. 30 ,,
5.	Assistant Mechanic	.. 81 ,,
6.	Engine Driver (1)	..173 ,,
7.	Engine Driver (2)	..106 ,,

Having been decided that the Hebbal Plough manufactured at an English Firm will be of a better material and of a superior finish, 200 ploughs were got made at Messrs. Ransome, Sims, & Jefferies, Ltd:, England, and have been received. They are being fitted up and sold at a price of Rs. 30 each.

On a requisition from the Assistant Director of Agriculture who wished to have a few cultivators of smaller sizes brought to use, a good number of steel tynes were made and sent to him. A few plough fastenings were made at the Farm Workshops and sold to the Implement Depot.

Three new imported ploughs were tried at the Hebbal Farm this year and nothing remarkable can be said about otheir work.

The important building works undertaken and finished this year are.—

1. Constructing a masonry trench silo at the Hebbal Dairy.
2. Excavating a well for the Botanical Section on the Hebbal Farm.
3. Laying a granite slab flooring for the threshing floor at the Hebbal Farm.
4. Constructing an engine house at the mulberry gardens, Mysore.
5. Deepening the well in the mulberry gardens at Mysore.
6. Extending the woven wire fencing at the Mulberry gardens, Mysore.

The course of instruction in Engineering has been amplified due to the fact of the training having to be given for three years of study, and the teaching has consequently been increased, with the result that the other functions were discharged with great trouble. It is, in this connection, that I have to lay stress on the necessity for an assistant, to give me relief to attend to other works.

The necessary repairs to the engines, tractor, lorry, and the tillage implements, and the manufacture of small implements for the farms and the Scientific Sections form the important work of the Workshops.

The small power milling outfit was sent out to a village called Srinivaspur, 5 miles from Channarayapatna, Hassan District, where the cane-milling and boiling work were done under the supervision of the Agricultural Inspector. The same outfit was next worked at the Government Sugar-cane Farm, Nagenhalli, where it crushed the canes of the Farm and those of a few raiyats round about.

The pumping outfit of the farm was sent to Mr. Naranayyar of Kolar, who got the water baled out of a few wells which he got deepened. A few more requisitions could not be complied with for want of another outfit of the kind.

The Petter Junior engine was employed to operate a fodder cutter which did work to the extent of making about 170 tons of silage material on the Hebbal Farm.

The lorry was engaged in full transport work for all the sections of the Department, the Babbur Farm, and the Agricultural School. It was specially useful in the prompt distribution of jola in the Tumkur District.

The duty of water experiments were continued on small plots lined with wate tight cement bunds.

The estate of Mr. Norris, Kengeri, was surveyed as per his requisition.

The same temporary staff as was employed last year was sanctioned this year. The number of letters coming in and going out are 1,640 and 1,790 respectively, which, when compared with those of last year, show an increase.

M. G. SINGRACHAR,
Agricultural Engineer.

TABLE I.

Items	Outstanding on 1st July 1922			Issues in 1922-23			Total
	Depots	Parties	Total	Depots	Parties	Total	Depots
1	2	3	4	5	6	7	8
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Bangalore (Credit Sales)	9,183 1 2	3,955 9 1	13,138 10 3	11,697 0 5	592 5 6	12,289 5 11	20,880 1 7
Mysore ,, ...	7,538 14 3	1,998 13 7	9,537 11 10	6,882 1 9	617 8 6	6,999 5 3	13,921 0 0
Tumkur ,, ...	7,094 1 0	624 9 5	7,718 10 5	661 14 5	382 13 0	1,044 11 5	7,755 15 5
Kolar ,, ...	12,323 8 7	940 8 9	13,264 1 4	6,452 10 8	38 15 3	6,491 9 11	18,786 3 3
Shimoga ,, ...	7,190 8 11	692 14 1	7,883 7 0	5,977 5 10	33 11 0	6,011 0 10	13,167 14 9
Hassan ,, ...	2,071 3 1	1,253 8 11	3,324 12 0	1,468 12 6	4 0 0	1,472 12 6	3,5369 15 7
Kadur ,, ...	4,642 2 8	252 0 10	4,894 3 6	3,902 7 6	3 4 0	3,905 11 6	8,544 10 2
Chitaldrug ,, ...	10,311 3 2	1,080 13 10	11,392 1 0	12,108 0 10	.....	12,108 0 10	22,419 4 0
Outside the Province	.....	44 8 0	44 8 0	.....	50 10 0	50 10 0	.....
Total ...	60,354 10 10	10,843 6 6	71,198 1 4	48,660 5 11	1,722 14 8	50,383 4 2	1,09,015 0 9
Issues on hire purchase system	.....	5,609 15 9	5,609 15 9	.....	186 14 0	186 14 0	.....
Cash sales	.....	.....	.....	.....	656 14 3	656 14 3	.....
Grand Total ...	60,354 10 10	16,453 6 3	76,808 1 1	48,660 5 11	2,516 10 6	51,177 0 5	1,09,015 0 9
Deduct value of stock on hand in all depots	51,445 15 5	.....	51,445 15 5	.....	.....	.....	51,445 15 5
Balance outstanding	8,908 11 5	.....	25,362 1 8	.....	.....	.....	57,569 1 4

Items	Dues		Collections in 1922-23			Outstandings at the end of June 1923		
	Parties	Total	Depots	Parties	Total	Depots	Parties	Total
	9	10	11	12	13	14	15	16
	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
Bangalore (Credit Sales)	4,547 14 7	25,428 0 2	11,758 1 2	827 8 0	12,585 9 2	9,122 0 5	3,720 6 7	12,842 7 0
Mysore ,, ...	2,616 1 1	16,537 1 1	8,789 15 1	813 15 4	9,603 14 5	5,131 0 11	1,802 1 9	6,933 2 8
Tumkur ,, ...	1,007 6 5	8,763 5 10	1,803 5 6	63 8 0	1,866 13 6	5,952 9 6	943 14 5	6,896 8 11
Kolar ,, ...	979 8 0	19,765 11 3	6,401 0 10	357 8 2	6,758 9 0	12,385 2 5	621 15 10	13,007 2 3
Shimoga ,, ...	726 9 1	13,894 7 10	8,413 9 5	12 8 0	8,426 1 5	4,751 5 4	714 1 1	5,468 6 5
Hassan ,, ...	1,257 8 11	4,797 8 6	1,915 5 2	443 7 3	2,358 12 5	1,624 10 5	814 1 8	2,438 12 1
Kadur ,, ...	255 4 10	8,803 15 0	3,640 9 11	27 4 6	3,667 14 5	4,904 0 3	228 0 4	5,132 0 7
Chitaldrug ,, ...	1,080 13 10	23,500 1 10	14,732 13 0	37 5 9	14,770 2 9	7,676 7 0	1,043 8 1	8,719 15 1
Outside the Province	95 2 0	95 2 0	.....	79 9 0	79 9 0	.....	15 9 0	15 9 0
Total ...	12,566 4 9	21,581 5 6	57,454 12 1	2,662 10 0	60,117 6 1	51,560 4 8	9,903 10 9	61,463 15 5
Issues on hire purchase system	5,746 13 9	5,746 13 9	.....	1,209 2 3	1,209 2 3	.....	4,537 11 6	4,537 11 6
Cash sales	656 14 3	656 14 3	.. ...	656 14 3	656 14 3	.....	... ..	.....
Grand Total ...	18,970 0 9	1,27,985 1 6	57,454 12 1	4,528 10 6	61,983 6 7	51,560 4 8	14,441 6 3	66,001 10 11
Deduct value of stock on hand in all depots ...	.....	51,445 15 5	Rs. 19,905-10-5 is included in the total column of Rs. 60,117-6-1			31,540 5 0	.....	31,540 5 0
Balance outstanding	.....	76,539 2 1	.....	.....	.....	20,019 15 8	.....	84,461 5 11

TABLE II.

Serial No.	Names of districts	Verity ploughs	Kolar Mission ploughs No. 8	Kolar Mission ploughs No. 9	Eureka ploughs	New bar share plough	Kirloskar ploughs No. 9	Kirloskar ploughs No. 100	Mysore ploughs	Kolar Mission cultivators	C. I. Workshop cultivators	Nahan sugar-cane mills	K. M.-F. 6 steel shares (imported)	K. M. F. 4 steel shares (imported)	K. M. F. 6 steel shares (local make)	K. M. F. 4 steel shares (local make)	K. M. cast shares (local make)	S. M. 7 shares	Local K. M. slip points	Steel bar points	Syracuse shares	Eureka shares	Eureka points
1	Bangalore ...	4	51	125	26	...	...	...	7	26	18	5	141	236	15	59	40	12	14	...	3	...	12
2	Mysore ...	7	13	...	31	...	...	...	6	35	...	8	37	92	...	...	36	12	30	...	4	24	60
3	Tumkur ...	6	...	...	1	...	...	...	1	6	...	...	63	88	...	1	...	...	...	...	1	12	10
4	Kolar ...	...	...	...	...	1	...	...	1	...	...	17	38	51	1	...	...	4	8	...	...	...	...
5	Shimoga ...	6	...	...	...	...	...	...	2	...	...	...	4	...	...	...	24	...	...	...	...	6	...
6	Hassan ...	...	...	...	...	...	...	...	...	6	...	...	6	6	...	...	...	...	...	...	...	12	12
7	Kadur ...	6	...	...	...	...	...	12	...	...	...	4	3	3	...	...	...	...	...	...	...	...	12
8	Chitaldrug ...	...	...	3	6	...	77	2	1	...	...	16	...	...	...	...	...	...	...	...	...	...	13
9	Outside the State	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	3	1	...	...
	Total ...	29	64	128	64	1	77	14	18	74	18	50	292	476	16	60	100	28	52	3	9	54	119

Serial No.	Names of districts	Verity cast shares (imported)	Verity cast shares (C. I. W. make)	Kirloskar plough shares	New bar plough shares	Verity plough landsides (C. I. W. make)	Verity plough bodies (C. I. W. make)	Verity plough wheels	K. M. plough landsides	K. M. plough moulboards	K. M. plough frogs	Round pans	Square pans	Western plough mould Boards	Plough chains	Skimming ladle frames	Ladle frames with fine sieves.	Ladle frames with rough sieves	Tynes for six-shovel cultivators	Solid eye mamties	Pick axes	Fire bars	Chaff cutter	Seed drill
1	Bangalore ...	3	1	...	2	...	...	...	7	2	9	...	...	...	7	...	...	...	...	...	...	...	1	1
2	Mysore ...	24	54	...	4	6	3	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...
3	Tumkur ...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6	...	...	...	...	...
4	Kolar ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5	Shimoga ...	...	...	...	...	...	...	...	...	...	...	...	...	18	5	...	12	9	...	...	...	18	...	...
6	Hassan ...	...	...	...	...	...	...	...	1	...	1	2	1	...	...	...	...	...	...	...	...	...	...	...
7	Kadur ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	12	6	...	...	62	24	...	...	...
8	Chitaldrug ...	280	157	350	...	67	2	30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
9	Outside the State ...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Total ...	308	212	350	7	73	5	30	8	2	10	2	1	18	15	12	18	9	6	62	24	18	1	

Report of work done on the Marthur Farm, during the year 1922-23.

Season and rainfall.—The rain-fall during the Calendar year of 1922 was slightly above the average being 97 inches 14 cents. It was withal evenly distributed and afforded optimum conditions for the growth of paddy. The incessant humid condition of the atmosphere from June right up to the latter half of September without any the least remission carried ill to sugar-cane and dry crops which thereby received a great set back to their growth. The late north-east showers of October and November have not been as profuse as they ought to be for the past three years.

The area under cultivation increased by 3 acres and 13 guntas as some portion of paddy plots lying uncultivated hitherto were reclaimed. From 28 acres 12 guntas; it rose to, 31 acres, 25½ guntas; of this sugar-cane occupied 4 acres, 5½ guntas; and paddy 15 acres, 29 guntas; areca 4 acres, 10 guntas; dry crops 4 acres, 38 guntas; orchard 2 acres, 13 guntas.

Sugar-cane.—Cane grew well in its initial stages and showed a great promise. But as soon as the heavy monsoon began to pour down with unrelenting force it bent down and looked as if powerless to put in any efforts at further growth. Its leaves turned red and it soon broke down in condition as if it was under a magic spell. It is surmised that this ill effect has been probably due to want of sufficient drainage. All possible attempts for digging deep drains to carry away all the superfluous water will be made in the monsoon of this year (1923) by which it is hoped to remedy this evil and allow the cane crop better opportunity to develop itself.

Red Mauritius was the first to succumb to this water-logged condition. It has thus been rightly discarded and has made room for 312, which has been used wholly for manurial experiments. Want of sufficient number of setts of one variety has compelled us to have recourse to several of them in our work; 544, 600, Java have formed units of trial for each compartment of our programme. All the manurial experiments, green manuring trials, spacing tests, etc., were completely upset by the above disturbing factor in the harmonious growth of canes. Thus, the bulk plot of R. M., gave only 20,320 lbs. or ten tons as against 14 tons to the acre yielded in the previous year.

Manurial Experiments.—The germination of cane was again very irregular in these plots. It will only be a sad mistake to think of arriving at any conclusion from the crops that these plots have produced. Anyhow, they gave an average of 23,097 lbs. per acre. The fuller report will probably be handed by the Chemical Section under whose kind auspices the experiments are tried on the Farm. The whole of our 312, which was our best cane, has this time been given to them for their experiments.

Varieties.—As was reported last year, 369, 313, 544, 312, and 600 were all tried side by side. The lower halves of these plots were also limed and there was thus a combination of two factors of experiments here. This liming, done as it was on the lower or better half, does not afford proof positive of its beneficient action. Anyhow Red Mauritius seems to have been remarkably improved by it and its yield on limed half rose to 67,870 lbs. or 34 tons, while the untreated portion fell to 39,480 or less than 20 tons. The increase has, as is plainly seen, been 70 per cent. This leads us to suspect whether this variety is calciphyllous which fact will have however to be confirmed by further investigation. I cannot vouch with certainty that liming had a hand in increasing the yields of the other varieties also. The improvement is small and may possibly be due to the inherent fertility of the soil of the lower half. This year liming has been done along the length of the line of cane. On another plot, it has again been repeated on the lower half as in this year.

Of the varieties 369 being the worst was eliminated from the Farm altogether. On the unlimed portion Red Mauritius was the last but one in its rank, while on the limed it topped the list, eclipsing even the tall 312. But as on account of its unfortunate dark-colour jaggory, it is tabooed all over, it must have its closing days and is bound to become a back number sooner or later.

Taking both plots together, 312 carries the palm and 600, with all its uneven germination and stand, follows closely behind. Three hundred and fifteen, with its numerous thin canes, forces itself to the third place, while 544 is pushed back as the fourth in spite of the remarkable thickness of its cane. Java did not germinate well at all and was teeming with blanks all over. Seeing that the crop of this variety was infinitely inferior on the farm to those that stood on cultivators' fields at other places in the malnad, I was tempted to feel that its seed on the Farm had deteriorated hopelessly. That a cane that had received a mark of favour from Arsikere to Nagar and covered an area of 1,000 acres in my division and a cane that had scored the unsolicited testimonial of the Madras cultivator, should be condemned unceremoniously was, I thought, very unjust. I have thus imported a couple of thousand setts from Nagar where the crop was peculiarly good and have got it planted separately by itself and also along with the other chosen varieties on several plots of the Farm. I append the yield figures got from varieties (*vide* Appendix III).

Green manure.—Growing green manure between lines of cane is one of the easiest methods of adding organic matter to the soil. This is only feasible where irrigation water is plenty, as otherwise at a time when cane itself will be struggling for quenching its thirst, the green manure crop will be an unwelcome burden. The addition of superphosphate to the green manure forces its growth. Two hundred and forty pounds to the acre is now the dose that we have fixed. Whether small doses will have the same effect remains yet to be investigated.

The results of the experiments are given in Appendix IV. It will be seen that in plot 5, the green matter from the portion that had super came to 4,944 lbs. to the acre as against 3,459 lbs. yielded by the untreated portion. I may here state in parenthesis that the germination on plots that had super was not good. It has come to my notice as a side issue that super retards germination when it comes in free contact with seed and its plumule. To avoid this danger the fertiliser should be mixed thoroughly well with the soil and copious irrigation should be given. The ridges on which the seed is sown should be moistened twice or thrice until the crop comes up a few inches high.

Turning back to the results of green leaf obtained, I may state that in plot 5 where the germination on the manure plot was somewhat better, the increase is visible to some extent, coming up to nearly 43 per cent. In plot No. 6 where the germination was bad the treated and untreated plots were pretty much the same, though there was a slight increase of 240 lbs. in favour of the manured plot.

The yields of subsequent cane show that the plots of super had 19,029 as against 10,653 in one case and 24,333 as against 18,880 in another. The figures from green manure alone indicate as though it acted as a depressing agent. A casual inference may at once arise that the increase in the super plots may be entirely due to super alone and not to green manure. But we have to pause yet a while until confirmatory results are obtained to swing the scale in its favour beyond any doubt. The results are vitiated and low yields are brought about by the inevitable delay in earthing up the cane. In the malnad and especially on the Marthur Farm where the soil is shallow, cane does not start growth until it is earthed up. As the green manure was sown somewhat late, the operation was delayed so long that it seriously affected the growth of cane itself. I am not thus prepared to attach any value to the results of this year.

The cowpea was the crop chosen for sowing between the lines of cane. It is seen that any variety of it will do provided it is sown thick in the case of erect-growing types. Sunnhemp may also be grown, but is more subject to the attack of insects than cowpea. It is besides more woody.

The application of superphosphate to cane seems to act beneficially on the Farm. But I feel that caution will have to be exercised in using it where there is dearth of water. I see that the canes that had the manure are yellowing where sufficient water could not be given.

Coming to plot 2 on which twin rows were arranged with 4½ feet of space in view to facilitate the growing of green manure, the cowpea evidently did not get enough moisture and develop into anything that may be called a crop. After earthing up, the canes did not receive enough water either. The action of super is here almost nil probably due to insufficiency of water from which the cane suffered in its initial stages.

Spacing Experiments.—Twin rows four feet apart between two sets of twins, single row three and two feet apart from each other were all tried. The results are as follows.—

Though twin rows show a slight advantage, their irrigation is difficult and with the sparse quantity of water we have, it is difficult with this method to feed enough of it to the cane. Though single rows two feet apart have given better results, the space between is not enough and does not allow of deep drains being dug in the monsoon for efficient drainage. The experiment is however being continued with Java a cane that does not tiller well.

On plot No. 4, instead of applying the whole dose of ammonium sulphate at earthing time as is usually done, half of it was used at planting with a view to find out whether that would induce more tillering and produce a better crop. The other half was of course given at earthing time. Though this method as shown by Appendix V has yielded advantageous figures, my faith in it has been shaken partly because the plot chosen exhibited woeful want of uniformity and partly because the crop as a whole had suffered from excess of moisture. It can also be seen that section three was the poorest patch and it unluckily came to the lot of the full dose of the sulphate at earthing time. If the other method had stepped in there, the tables would have turned and the results told a different tale. Space on the Farm would not allow of the experiment being continued again this year. I shall provide for it in January 1924.

Nitrolim.—This year nitrolim has been tried on cane and though it was applied a week before planting and was thoroughly mixed with the soil, it still seems to have interfered with the germination of the cane.

Areca.

Manurial Experiments.—The areca trees all looked very green and healthy and the general appearance of the whole garden improved a good deal on account of the artificial manure given to it. The individual results and other details will probably be reported upon by the Chemical Section who have very kindly borne the brunt of carrying on the experiment.

Fifty-three plants have been transferred to their permanent places. About one thousand seedlings have been removed to the brink of drains. Thirty rows have been earthed up.

Another experiment is on its way to see if it will be possible to grow green manure between areca trees. Both sunnhemp and cowpea have been sown for the purpose. Good growth has been put in by both these crops and the best time at which this sowing has to be done to provide good covering to the land during the heavy monsoon must be found out by repeated experiment. Encouraging results have been obtained so far and some of the garden owners have also consented to undertake the trial on their lands at the persuasion of Inspector Chayapathy.

Paddy.—There seems to be an anomalous practice on the Farm in connection with the transplantation of paddy. The dry sowing of plots is done in April, while even the nursery is tackled in July for raising the seedlings for transplantation. Thus the sown crop will be at least 2½ months in advance of the transplanted crop. The sown crop will therefore have a life of more than seven months and the transplanted one which in the ordinary course of events ought to have been a longer term finishes its career in less than five months. This is probably why the transplanted crop fails to produce as much as the sown one on the Farm. There may also be other reasons for this, but to give a crop an unfair and distinct disadvantage and condemn it as inferior is on the face of it extremely unjust. Want of water is an irresistable bar to the laying out of nursery just at the same time. Dry nurseries will have to be arranged for and kept alive by artificial irrigation which perhaps is not always convenient. The experiment of transplanting in July will be tried this year at least on small portions of the Farm.

Varieties.—The early varieties were all eliminated as none of them did well. They are being grown on some of the non-experimental portions of the Farm. The practice of sowing and transplanting in contiguous plots was discontinued. This entailed a lot of difficulty in conducting the agricultural operations on small alternate plots. Thus the upper half of the area was devoted to sowing while the lower

half had transplantation. Thirteen varieties were chosen and their performance is shown in Appendix No. VI. Hosahalli Belebhatta imported from Hassan seems to have done best. The varieties had all been badly mixed up with one another. Our thanks are due to Mr. Badami, Sr. Assistant Botanist, for the trouble he took in separating them as far as possible.

Manurial experiments.—These were conducted as per kind directions of the Chemical Section. The results are tabulated in Appendix No. VII. As the crop was transplanted late and did not get sufficient time to attain normal growth, the different treatments do not show any convincing results. This year, paddy has been sown on all these plots and I anticipate that beneficial effects will be produced by the application of manures and permit of interesting conclusions being drawn from them.

Green Manure.—Twelve plots were chosen for this purpose from the varietal area, and cowpea and sunnhemp were sown. The other and more important aim of the experiment was to find out how far the application of super would stimulate the growth of leaf. This manure was given to both cowpea and sunnhemp plots and these were interspaced by unfertilised plots. Every treatment was repeated thrice, and the results are as follows—*vide* Appendix VIII.

In the case of cowpea, the effects of green manure do not seem to be so beneficial. The total green matter produced improved by the application of super, rising up to 3,560 lb per acre as against 1,640 got from the unfertilised plot. Again, the cowpea on the fertilised plot began to bear pods one month earlier than its complementary plot that had no manure. As a matter of fact, it was full of pods when it was ploughed in. This probably accounts for not obtaining striking results from the subsequent paddy crop.

Sunnhemp, on the other hand, yielded by the application of super five times as much leaf as it did when it got no fertiliser. The actual figures were 13,680 lb per acre on super plot as against 2,920 on no-super plot. The subsequent paddy showed improvement by 680 lb or by 37 per cent. The yield on the fertilised plot rose to 2,520 lb from 1,840 that was got from the untreated portion. It will also be interesting to watch what residual effect the large quantity of sunnhemp ploughed into the soil will show in years to come. The plots that had no green manure gave only 1,360 lb to the acre, which means that the yield improved by 35 per cent by the application of green manure alone. The experiment is being continued this year also and even the bulk area on which paddy will be drilled dry has been sown with sunnhemp. This has, I am glad to say, developed into a good decent crop.

As there were lot of failures in the sown area of paddy, the crops here averaged only to 1,378 lb to the acre in "I" range. In the varietal plots, the drilled paddy gave 2,300 seers per acre on the whole, while their complementary ones that had transplantation method dwindled down to 1,310 seers per acre. In the "H" range, where paddy is rotated after cane, the average came to 2,043 due to the residual effect of manure applied to cane. The green manure plot gave an average of 2,200. The yields of several areas are given in the Appendix IX. It will be interesting to note that the calculated profit on paddy figures went up to Rs. 691-1-11.

Dry crops.—On account of the incessant rainfall, the dry crops suffered a good deal. M.M. I. ragi gave 125 seers and other ragis 100 seers to the acre.

Chillies.—As the varieties grown on the Farm are not appreciated by the consumers and thus find no market locally, we may have to once for all eliminate them from the Farm. Anyhow, they gave 21 maunds to the acre. Some of them will, however, be kept on for another year.

Groundnut.—Groundnut gave a low return of 394 lb to the acre.

Orchard.—The oranges and sweet limes are still putting forth extraordinary leaf and wood. A few trees bore one or two good sized fruits. I am afraid the amount of water in the rainless period is not enough to induce profuse fruiting. Mangoes of Sunder-sha and Malgoa varieties have just begun to make their maiden attempts at fruiting.

It has now been arranged to start another orchard on the slope adjoining the paddy area at a lower level. Plants will be put in about next August.

Figs are almost gone. Apples are affected by borer and are dying one by one. They unfortunately came to bearing in the rainy season and all possible means to save the fruits from the relentless rain have failed. Pomegranate fruits rot and die similarly in the monsoon.

Silo.—In addition to the existing pit, a big trench was dug for ensiling grass. The ensilage made in the trench was not so good as that got from the pit. Much more grass had rotted and had to be thrown away.

Pepper.—Two thousand and five hundred cuttings were got from Taliperamba and about 10 per cent of them have finally succeeded in striking root and are now growing.

D. G. RAMACHANDRA RAO,
Assistant Director,
Shimoga.

APPENDIX I.

Showing yield of jaggery during 1922-23.

Variety	Area	Weight of cane	Weight of cane per acre	Weight of jaggery	Setts sold	Remarks
	A. g.	lb	lb	Mds. lb		
1. Red Mauritius	1 2	30,988	20,320	78 14	18,808	Bulk plots.
2. Do ...	2 28	39,232	23,087	163 17	...	Artificial manurial plots.
3. Varieties ...	34	30,641	36,048	2 7	28,082	
4. Elephant cane	2½	951	15,216	71 19	400	
Total ...	4 5½	101,812	94,681	316 1	47,290	

APPENDIX II.

Results of spacing experiments on Sugar-cane.

		Per plot of 1½ acres. lb	Enclosed average per acre lb
Red Mauritius ...	8 double rows of 4' 2'	1,968	26,240
„	18 single rows of 3' apart	1,615	21,533
	27 single rows of 2' „	2,141	28,546

APPENDIX III.

Sugar-cane varietal tests during 1922-23.

Varieties	Per plot 1½ G.		Per acre average	
	Limed	Unlimed	Limed	Unlimed
Plots 7 *and* 17.				
R. M.	1,523	898	60,920	35,920
H. M. 369	320	275	23,466	20,133
H. M. 315	1,878	1,558	59,023	48,965
Plots 8 *and* 18.				
R	1,893	1,076	74,820	43,040
H. M. 544	1,324	1,173	52,960	46,920
H. M. 312	1,727	1,312	69,080	52,480
H. M. 600	1,349	1,100	65,951	53,777

APPENDIX IV.

Sugar-cane Green Manurial experiments during 1922-23.

Different kinds of manures treated	Green manure		Yield of cane	
	Per plot of 1½ G. lb	Average per acre yield lb	1½ G. plot lb	Yield of cane average per acre yield lb
Plot No. 5 R. M. canes.				
Green manure with super	373	4,944	714	19,029
Green manure	261	3,459	324	8,653
Check	.....	.....	399	10,653
Plot No. 6 H. M. 312.				
Green manure with super	276	3,588	913	24,333
Green manure	260	3,345	608	16,180
Check	.....	.....	708	18,880
Plot No. 2. 4½×1½' apart.				
Green manure only	.....	.....	538	10,760
Super to green manure	.....	.....	540	10,810

APPENDIX V.

Artificial Manurial Trials in Sugar-cane plot 4 of Marthur Farm.

Number of plots	Description of manures used	Yield of cane per plot of 1½ guntas	Yield of cane average per acre
		lbs.	
I	1. Full dose of ammonium sulphate at the time of earthing (250 lb per acre).	920	24,533
	2. Half dose at the time of planting, half at the time of earthing.	799	21,307
II	Full dose of ammonium sulphate at the time of earthing.	1,152	30,720
	Half dose at the time of planting and half dose at the time of earthing.	1,630	43,466
III	Full dose of ammonium sulphate at the time of earthing (250 lb per acre).	434	11,573
	Half dose at the time of planting and half at the time of earthing.	982	26,190

APPENDIX VI.

Statement showing yield of Paddy Trial in "A. F." Ranges for 1922-23.

No.	Variety	Number of plots	Area in guntas	Yield in lbs		Average per acre in lb
				Grain	Straw	
1	Hosalli Bele Bhatta ...	2	2	136	251	2,720 Sown.
	Do „ ...	2	2	66	83	1,320 Transplanted.
2	Puttasanna „ ...	2	2	130	210	2,600 Sown.
	Do „ ...	2	2	63	94	1,260 Transplanted.
3	Doddabele „ ...	2	2	128	183	2,560 Sown.
	Do „ ...	2	2	68	80	1,360 Transplanted.
4	Mullaggi „ ...	2	2	127	183	2,540 Sown.
	Do „ ...	2	2	67	91	1,340 Transplanted.
5	Sidda Sale „ ...	2	2	126	192	2,552 Sown.
	Do „ ...	2	2	73	96	1,460 Transplanted.
6	Walya „ ...	2	2	122	161	2,440 Sown.
	Do „ ...	2	2	68	80	1,360 Transplanted.
7	Bile-bhatta „ ...	2	2	118	193	2,360 Sown.
	Do „ ...	2	2	58	75	1,160 Transplanted.
8	Jaddu „ ...	12	12	706	1,200	2,353 Sown.
	Do „ ...	12	12	412	557	1,373 Transplanted.
9	Musalli „ ...	2	2	110	181	2,200 Sown.
	Do „ ...	2	2	61	90	1,220 Transplanted.
10	Shimoga Sanna „ ...	2	2	105	168	2,100 Sown.
	Do „ ...	2	2	68	87	1,360 Transplanted.
11	Honasu „ ...	2	2	100	67	2,000 Sown.
	Do „ ...	2	2	59	70	1,180 Transplanted.
12	Hasadi „ ...	2	2	91	167	1,820 Sown.
	Do „ ...	2	2	60	68	1,200 Transplanted.
13	Kavari „ ...	2	2	86	161	1,720 Sown.
	Do „ ...	2	2	53	80	1,060 Transplanted.

APPENDIX VII.

Paddy Manurial Experiments during 1922-23.

Plot number	Description of manures used	Yields of grain		Straw	
		Per plot of 3 guntas	Average per acre	Per gunta	Average per acre
I	Cattle manure	112	1,493	134	1,786
	Do 2·5 Ammonium sulphate ..	124	1,653	171	2,280
	Do 2·5 Do and 7·0 super ..	145	1,933	188	2,506
II	Do 10·5 super & 2·5 Ammonium sulphate.	98	1,306	124	1,653
	Do 10·5 super & 3·75 Ammonium sulphate.	116	1,546	144	1,920
	Do 10·5 super & 5·0 Ammonium sulphate.	131	1,746	172	2,293
III	Do 3·75 Ammonium sulphate 3·5 super	124	1,653	168	2,240
	Do 3·75 Ammonium sulphate 7·0 super	136	1,813	202	2,693
	Do 3·75 Ammonium sulphate 10·5 super	129	1,720	168	2,240
IV	Do 10·5 super, 6·25 ground-nut cake. ...	109	1,453	144	1,920
	Do 10·5 super, 9·5 Mds. of cake ..	122	1,626	179	2,386
	Do 10·5 super, 12·5 Oil cake ..	116	1,543	162	2,160

APPENDIX VIII.

Green Manurial Plot (1922-23)—Plot $\frac{1}{40}$ acre in area.

With super.

	Green	Subsequent paddy grain	Straw
Sunn-hemp	372	63	84
	574	62	82
	229	63	88
Average plot	392	63	85
,, per acre	15,680	2,520	3,400
Cow-pea	94	48	59
	101	58	79
	73	49	62
Average per plot	89	52	67
,, per acre	13,560	2,080	2,680

Without super.

Sunn-hemp	116	52	79
	52	40	49
	50	65*	81*
Average per plot	73	46	64
,, per acre	2,920	1,840	2,560
Cow-pea	70	53	60
	35	56	66
	18	51	64
Average per plot	41	53	60
,, per acre	1,640	2,120	2,520

Average untreated per acre.

	Grain	Straw	
Average per plot	34	46	....
,, per acre	1,360	1,840	....

* Left out as being the last plot; it exclusively receives the rich drainage water from the areca garden and has borne an extraordinary crop.

APPENDIX IX.

Paddy Results for 1922-23.

Name of Range	Area		Yield	Yield per acre	Estimated cost	Expenses
			Transplanted.			
	A.	g.			Rs.	Rs. a. p.
Paddy bulk H. Range ..	5	15½	11,246	2,043	....	....
A. to F. Range ..	0	36	1,176	1,310	....	....
I Range	0	36	1,472	1,635	....	....
A. to F. Range Green manurial experiments (cow-pea and sunn-hemp).	..	..	....	....	955	263 14 1
	0	12	660	2,200	Profits	691 1 11
Varieties "I" Range ..	2	4	848	404	....	....
Paddy extension area H. Range.	1	11	2,330	2,000	....	....
			Sown.			
A. to F. Range	0	36	2,067	2,300	....	....
"I"	3	39	6,312	1,578	....	....

W D 723—GPB—555—7-5-24